The Electrical Industry's Weekly Magazine

August 25, 1958

Electrical World

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A McGraw-Hill Publication

Modern concepts in substations:

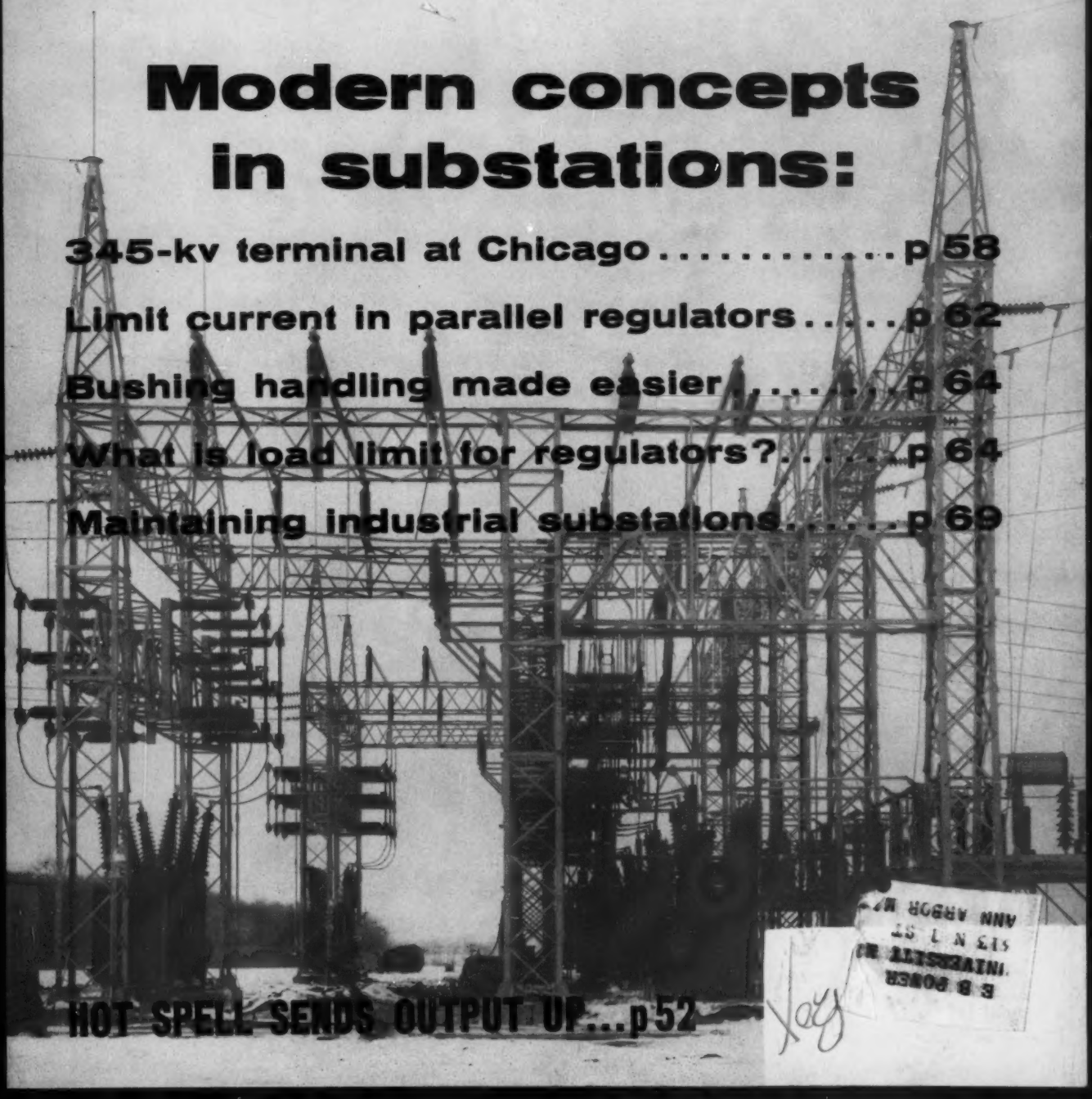
345-kv terminal at Chicago ..... p 58

Limit current in parallel regulators ..... p 62

Bushing handling made easier ..... p 64

What is load limit for regulators? ..... p 64

Maintaining industrial substations ..... p 69



HOT SPELL SENDS OUTPUT UP...p 52

ANN ARBOR M
E B POWER
INSTRUMENTS

NEWEST RESULT OF RESEARCH at General Electric is the industry's first 2-cycle, 13.8 kv magne-blast circuit breaker. Switchgear Development Laboratory personnel test new 2-cycle breaker (shown in test bay) under field conditions to better evaluate equipment improvements.

How electric utilities benefit from General Electric's new 2-cycle breaker

From General Electric's Medium Voltage Switchgear Department comes a new 2-cycle, 13.8 kv magne-blast circuit breaker specifically designed for electric utility distribution applications.

G-E 2-CYCLE BREAKER promises *three immediate benefits* to utility distribution planners:

(1) reduced line burning
(2) better protection against conductor annealing
(3) improved coordination with other distribution protective devices

The 2-cycle, 13.8 kv breaker—along with a companion 2-cycle, 4.16 kv breaker—is the latest demonstration of General Electric's leadership in this field.

FOR COMPLETE DETAILS, contact your local General Electric Apparatus Sales Office. General Electric Company, Section 301-383, Schenectady 5, N. Y.

MORE POWER TO AMERICA

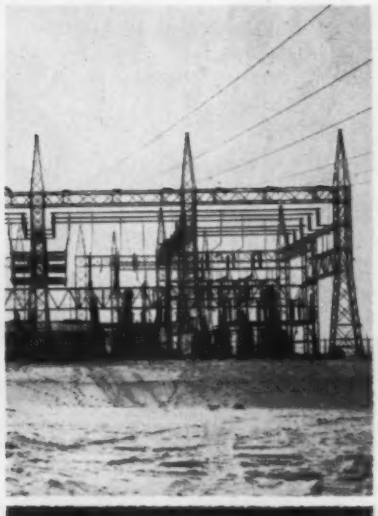
GENERAL ELECTRIC

Electrical World

Vol. 150, No. 8 AUGUST 25, 1958

Published for 84 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue



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CURRENT EVENTS

Hot Spell Sends Output Skyward

Air conditioning helps bring record-busting 12.7 billion kwhr output for week. Water conditions favorable.....p 52

INDUSTRIAL

Guides for Maintaining Industrial Subs

Tests for oil and insulation are given in this first article of a 3-part series on industrial substation maintenance.....p 69

SUBSTATIONS

Chicago Gets its First 345-Kv Substation

J. H. Schroeder and H. P. Tosch, Commonwealth Edison

Commonwealth Edison's new facility terminates tie with American Electric Power; joins 345, 138-kv systems.....p 58

Regulator Control Circuits Designed

H. C. George, Detroit Edison Co

Detroit Edison plans 3 schemes to limit circulating current in paralleled regulators feeding common load.....p 62

How Much Overload for Regulators?

H. C. Brem and R. A. Studer, Allis Chalmers Mfg. Co

Guide for permissible overloading should be based upon physical limitations and loss of insulation life.....p 65

Bushing Handling Made Easy

Houston Lighting & Power develops special racks and carts for handling, storing, and repairing bushings.....p 64

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In Idaho Power's brand new East Gate Substation at Twin Falls, Idaho, CM-OT control cable is used on control circuits involving transformers, regulators, metering devices and circuit breakers. Much of the equipment is located in the yard, with cables going underground and up into the main control board.

"We expect 30 years' service from this direct-burial cable," says Idaho Power Company

On its substations along the Snake River, Idaho Power Company uses a direct-burial cable that eliminates the need for conduit or pipes . . . provides complete resistance to soil alkalinity, severe temperature fluctuations and active rodents, as well as excellent mechanical protection.

It's Okonite's Watertite-Okoprene control cable with CM-OT* finish—a lightweight, flexible cable of great compressive strength. Heart of CM-OT construction is a corrugated bronze tape that gives unusually high compressive strength. The corrugated tape is bonded to a tough wall of Okoprene, reinforced by an Okoprene-filled tape overall. This composite covering provides a permanent barrier against rodents, moisture, soil alkalies, acids, oils, sunlight or mechanical damage.

It will pay you to learn more about CM-OT quality cable constructions with corrugated bronze tape protection. Send for Bulletin EW-1121, The Okonite Company, Passaic, New Jersey.

Corrugation = strength plus lightness

Just as corrugated construction adds strength to underground pipes, so corrugation of shielding tape permits the construction of CM-OT—the stronger, lighter, more flexible and more easily handled cable.

* Patent No. 2722562

where there's electrical power . . . there's **OKONITE CABLE**

6201

Are Electric Systems Obsolete?

Today, the editors of Electrical World are in the field calling on utilities throughout the country to secure a comprehensive picture of areas of system obsolescence. And, as usual, they are securing complete cooperation in this endeavor. Already we have amassed a long list of areas and substantial data covering potential obsolescence in design, construction procedures, equipment, and operating and maintenance practice.

We have not presumed to find nor do we expect to find that utilities have been remiss in maintaining their high standards for system facilities and in following modern methods for all areas of design, construction, operation and maintenance.

We do expect to find many system elements that are inadequate for the job ahead. We expect to gather a mass of information and ideas on critical areas that are most likely to be vulnerable in the face of future requirements.

We will appreciate the full assistance of our utility friends and pledge to them that our series on modernization will provide them much food for thought.

Fischer Black

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No. 8 in a series

Right off the Wire

About half of this country has been converted to dial telephones and it is expected that within five or ten years, it will be possible to dial Europe or the Hawaiian Islands.

&

Two new developments in "fiber optics" (the use of glass or plastic fibers to transmit light around curves) are in the examination of the inside of the human body and in cryptography.

&

A new plastic reinforced with silica withstands high temperature better than steel.

&

A new technique in the use of radar antennas which involves sweeping the beam will give them a range of 3,000 miles without increasing their size.

&

Simplex researchers, D. W. Kitchin and O. S. Pratt, have developed techniques for taking photomicrograph movies of polyethylene insulation failures caused by excessively-high voltages.

&

A thermo-electric engine, based on the temperature differential between dissimilar metal plates, converts atomic energy directly into electricity with a thermal efficiency of twelve per cent.

&

A new machine uses the light from atoms of mercury to control the engraving of lines on diffraction gratings which must be less than a wave length of light apart. Accuracy is closer than one-millionth of an inch.

&

The strength of cast iron and resistance to high temperature are combined with good electrical resistance in a new ceramic.

By using a clock based on the vibration of an atom of cesium, it has been found that the length of our day has been increasing half a thousandth of a second per year.

&

A new television picture tube has a front of double glass with mineral oil between. This increases light transmission by reducing reflection.

&

A two-volt booster battery is made to supplement a regular automobile battery. It is used only in starting.

&

Simplex ANHYDREX XX insulation has greater resistance to deterioration at elevated operating temperatures than any natural rubber of GR-S heat resisting insulation.

&

A ramjet power plant for permanent earth satellites has been designed which would obtain its power from the re-combination of oxygen atoms that have been divided by cosmic radiation in the higher altitudes.

&

Further information on these news items and on Simplex cable is available from any Simplex office. Please be specific in your requests.

&

An electron tube the size of a shirt button is made of layers of titanium and ceramic. It makes the tube competitive in size with the transistor.

&

An instrument for detecting radiation is said to be so sensitive that it can detect a thousandth of a gram of chromium 51 dissolved in a river.

&

A patent has been issued for a television set that shows two programs superimposed on one screen. The images are separated by polarizing glasses and individual earphones reproduce the sound.

A treatment for metal bearings is claimed to make it possible to run them indefinitely without lubrication. It has also been tested on power press tools.

&

A three-dimensional cathode-ray tube gives a display with a depth of one mile.

&

A steel roller for a new paper mill is said to be the largest in the world. It is over twenty-six feet long and is forty-four inches in diameter.

Submarine cables for railroad use!

Submarine cable is required by the New Haven R.R. for the power and control of 24 movable spans at 14 railroad bridges. Old style steel armored cable suffered the ravages of salt corrosion, strong currents and constant flexing, all of which resulted in high maintenance. Replacements, as required, are made with new Simplex submarine cable, jacketed in fabric-reinforced neoprene — a product of Simplex research — a remedy for delayed service and high maintenance costs.

SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and
Newington, New Hampshire

Simplex

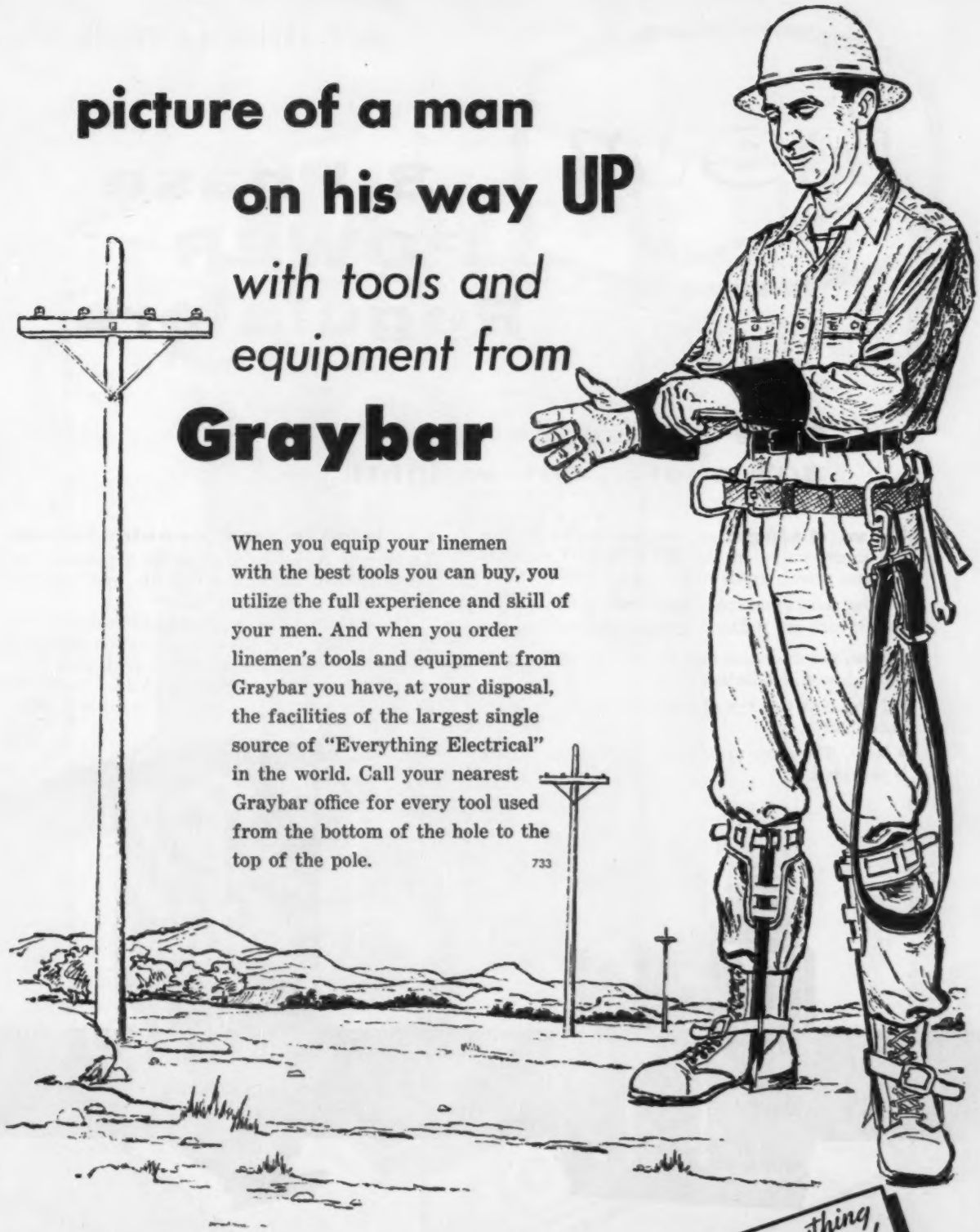
Highest quality cables for: Mining
Power & Lighting • Construction
Transportation • Communications
Signalling

"The American manufacturers of transoceanic telephone cables"

picture of a man on his way UP

with tools and equipment from

Graybar



When you equip your linemen with the best tools you can buy, you utilize the full experience and skill of your men. And when you order linemen's tools and equipment from Graybar you have, at your disposal, the facilities of the largest single source of "Everything Electrical" in the world. Call your nearest Graybar office for every tool used from the bottom of the hole to the top of the pole. 733

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IN OVER 130 PRINCIPAL CITIES

Allis-Chalmers—25 Years

new

3-Phase POWER Regulators

Save 33% space... 30% cost... 20% weight!

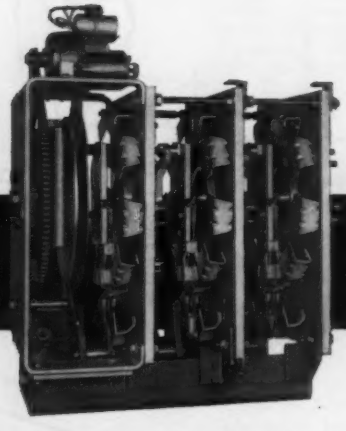
New design — new benefits to utilities are incorporated in the *NEW* Allis-Chalmers 3-phase power regulators.

- Now, substation space requirements for power regulators are reduced by at least one-third.
- Now, reduced sizes and weights for easier handling, lower installation cost.
- Now, cost per kva of 3-phase regulators is reduced 30%.
- Now, 600-amp maximum *Vari-Amp* rating is provided.

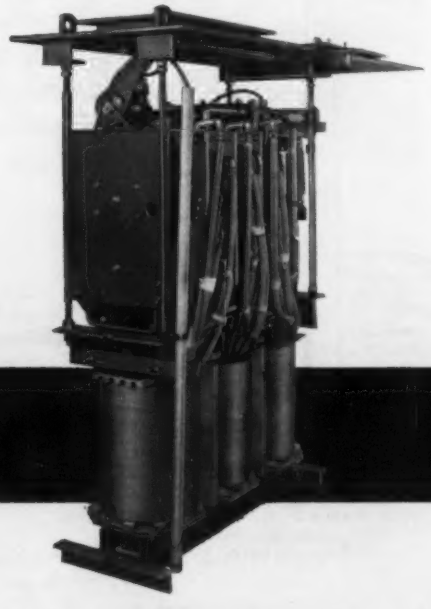
Available in most popular ratings

These new Allis-Chalmers power regulators are rated 500 and 750 kva, 8660 volts, and 500, 750 and 1000 kva, 13,200 volts.

These savings are so important it will pay you to re-evaluate your present substation planning on the basis of these new units. Check with your nearby A-C office or contact Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.



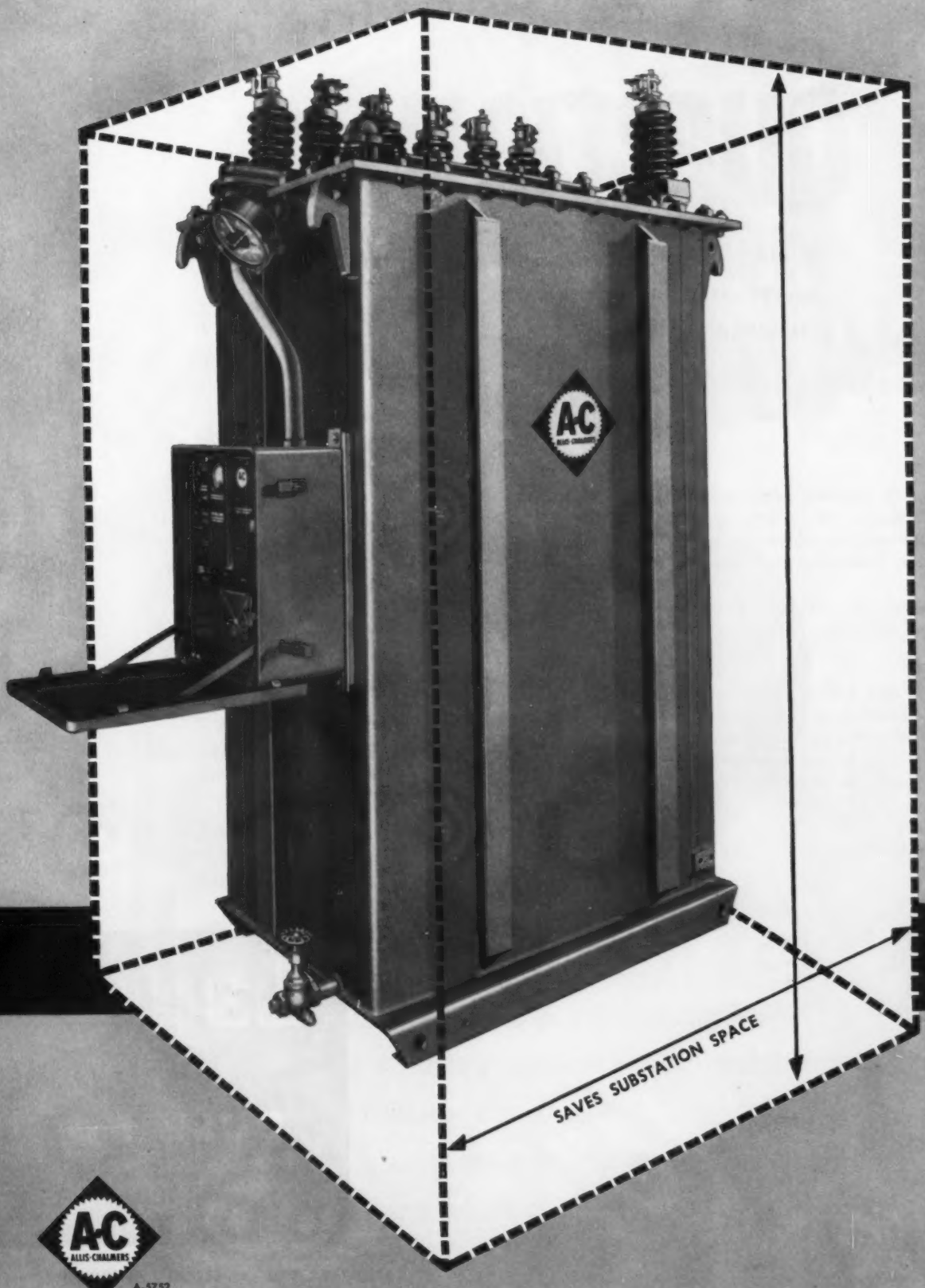
Heavy-duty tap-changing mechanism.



Unit construction combined with new space-saving arrangement of tap-changing mechanism.

ALLIS-CHALMERS

of Leadership in 5/8% Regulators



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QUESTION:

WHAT IS MOST RELIABLE INSULATING MATERIAL FOR EXPOSED INSULATION?

ANSWER:

WET PROCESS ELECTRICAL PORCELAIN

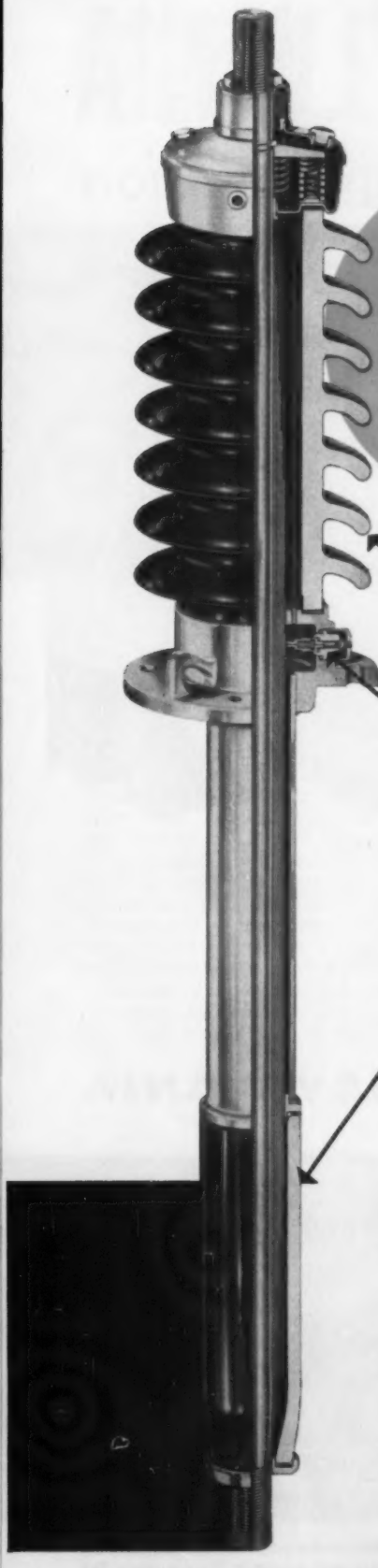
Porcelain is inorganic, non-deteriorating and rugged. At high operating voltages, it can withstand leakage currents without tracking, and without permanent damage to its surface.

Lapp

POC*

BUSHING

*PAPER-OIL CONDENSER TYPE
TOTALLY-ENCLOSED CORE
ASA STANDARD



IN LAPP POC* BUSHING DESIGN

PORCELAIN does 3 big jobs

1. WEATHER CASING of porcelain provides flashover distance . . . protects insulated core from moisture and weather . . . and with Lapp Fog-Type corrugations provides most-effective surface to withstand leakage currents under atmospheric contamination.

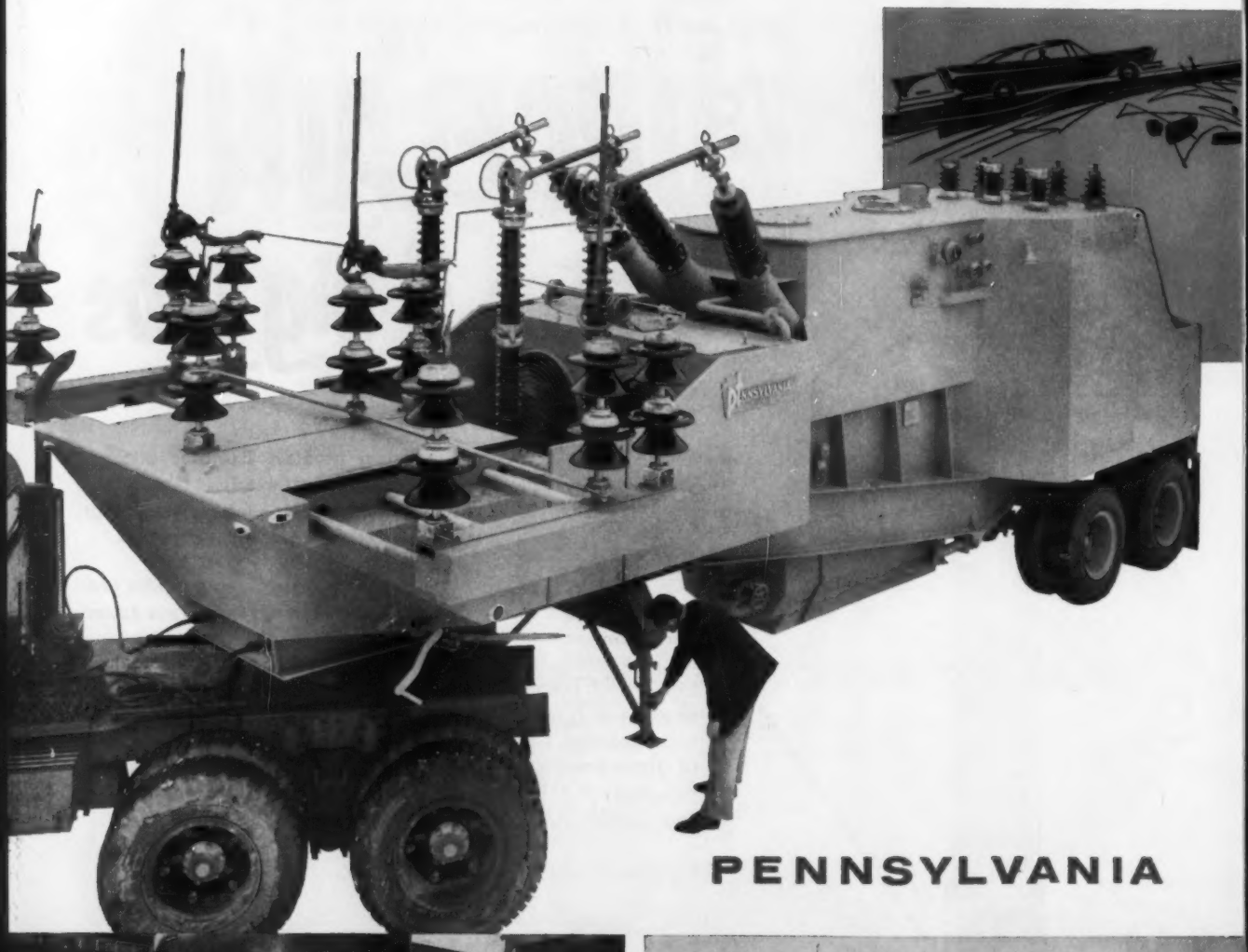
2. POWER FACTOR TAP is insulated by porcelain; provides permanent uniform insulation . . . assures reliability of power factor test readings.

3. SHANK of porcelain encloses paper-oil core, isolates it from oil in the tank. It has a non-tracking, non-deteriorating surface which will withstand leakage currents which arise from contamination of circuit breaker or transformer oil. Makes storage of spare bushings easy, too, because porcelain shank requires no protection from natural elements.

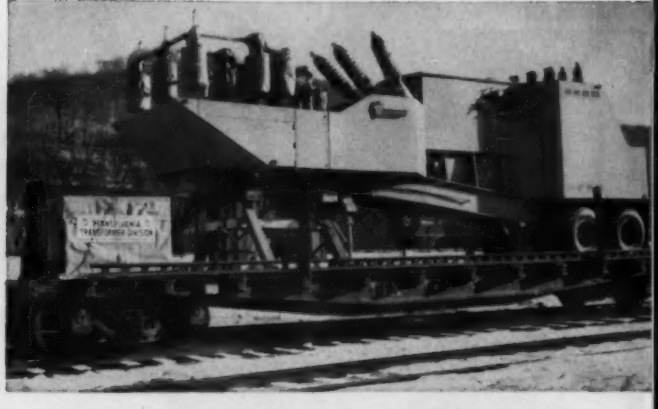
Lapp Insulator Co., Inc., Le Roy, N. Y.

ALL EXPOSED INSULATION ON EVERY LAPP POC* BUSHING . . . FROM 15kv UP . . . IS LAPP VACUUM-PROCESS PORCELAIN

NEW 15000 KVA PENNSYLVANIA



The rear compartment and platform of Pennsylvania's new Transmobile provide easy access to the low voltage circuit breaker, control equipment, metering devices, etc.



Shipped by rail, the Transmobile was unloaded by backing a tractor under the trailer and driving it down a ramp. The 15000-kva unit was shipped fully assembled.

MOBILE SUBSTATION meets normal highway clearances . . .

Pennsylvania "Transmobile" speeds complete substation service wherever it's needed

One of the highest-capacity mobile substations in the United States now rolls over the highways of a southwestern utility to wherever it is needed for emergency or maintenance service. This substation on wheels, a new Pennsylvania Transmobile, also serves as a replacement unit for the utility whenever permanent facilities are being altered or enlarged.

Designed and built by Pennsylvania Transformer, the three-phase, 15,000-kva Transmobile has a high voltage of 64,400△ volts, with two full-capacity taps above and two below normal. The low voltage is 12,470Y/7200 volts.

The substation includes a high voltage air-break switch, which is retractable when the Transmobile is being moved, high voltage and low voltage lightning arresters, metering and auxiliary power transformers, metering current transformers, a low voltage oil circuit breaker, a phasing transformer, and high voltage fuses.

Mobility of the Pennsylvania Transmobile is excellent, despite its high capacity and complete complement of substation equipment. With high voltage fuses removed, all three dimensions meet normal highway clearances. Only the weight exceeds normal highway limitations—but the total weight is well within the maximum agreed upon between the utility and the state.

Pennsylvania Produces All Types and Sizes of Custom-Designed Mobile Substations

Putting power on wheels is nothing new for Pennsylvania Transformer, whose experience with mobile units ranges from small distribution transformers to fully equipped substations like the one shown. A 15,000-kva mobile autotransformer (138—69 kv) is now under construction for the same southwestern utility.

If you are considering adding mobility to your own system, a consultation with Pennsylvania's experienced engineers will not obligate you in any way. Contact Pennsylvania Transformer Division, McGraw-Edison Company, Box 330, Canonsburg, Pa.

POWER TRANSFORMERS

5000 KVA PENNSYLVANIA MOBILE SUBSTATION
High voltage: 11500△ x 34500 volts. Low voltage: 2520/4360Y/2520 x 7560/13090Y/7560 volts.

3750 KVA PENNSYLVANIA MOBILE SUBSTATION
High voltage: 25700 x 51400△ volts. Low voltage: 2520/4360Y/2520 x 5040/8720Y/5040 x 7560/13090Y/ 7560 volts.

NEW UTILITY STATIONS, C-E EQUIPPED

Includes only new stations on *new* sites placed in operation since JANUARY 1, 1950.

LAKE CATHERINE
HUTCHISON
YATES
DUNKIRK
TITUS
LEE
CONTRA COSTA
HAWTHORN
NINEMILE POINT
EDGE MOOR
PALATKA
JOHNSONVILLE
DANSKAMMER
BECKJORD
HIGHGROVE
PLANT X
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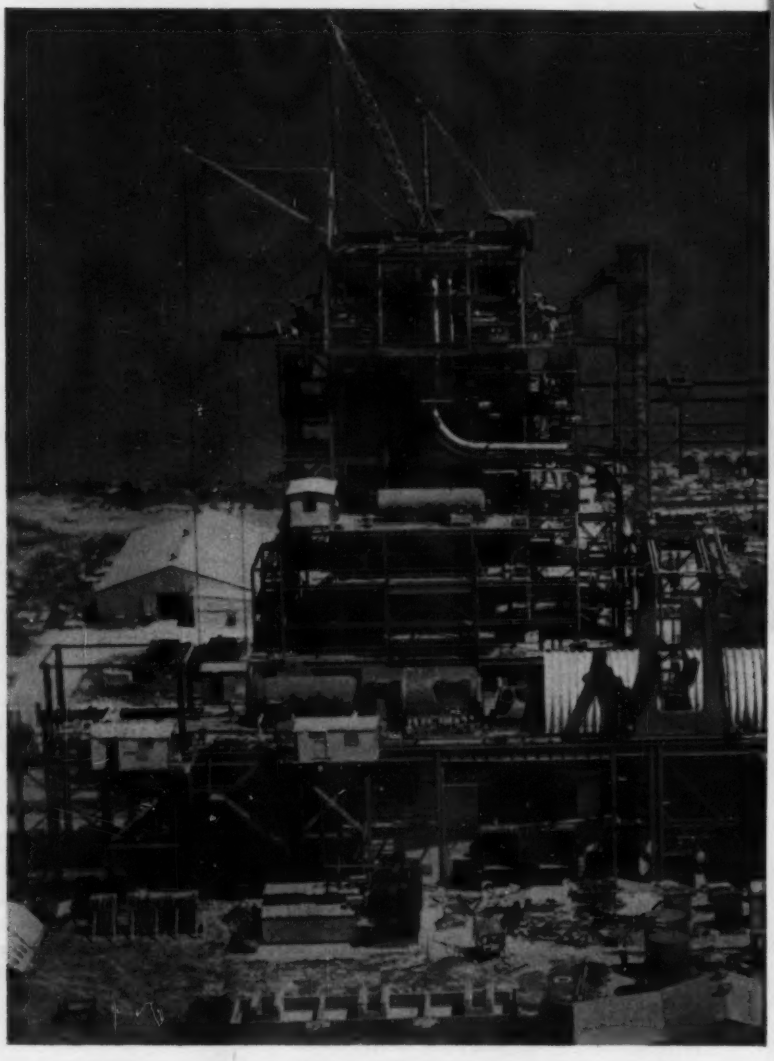
URQUHART
KINGSTON
SANDOW
MULLERGREN
BARRY
NORTH OMAHA
WILMINGTON
CARBON
SAGUARO
MORRO BAY
VERMILION
JOHN SEVIER
COLLIN
MILLIKEN
GALLATIN
BARRETT
MITCHELL
SAN BERNARDINO
YORKTOWN
GULF COAST
TUCSON
PORT WENTWORTH

W. A. PARISH

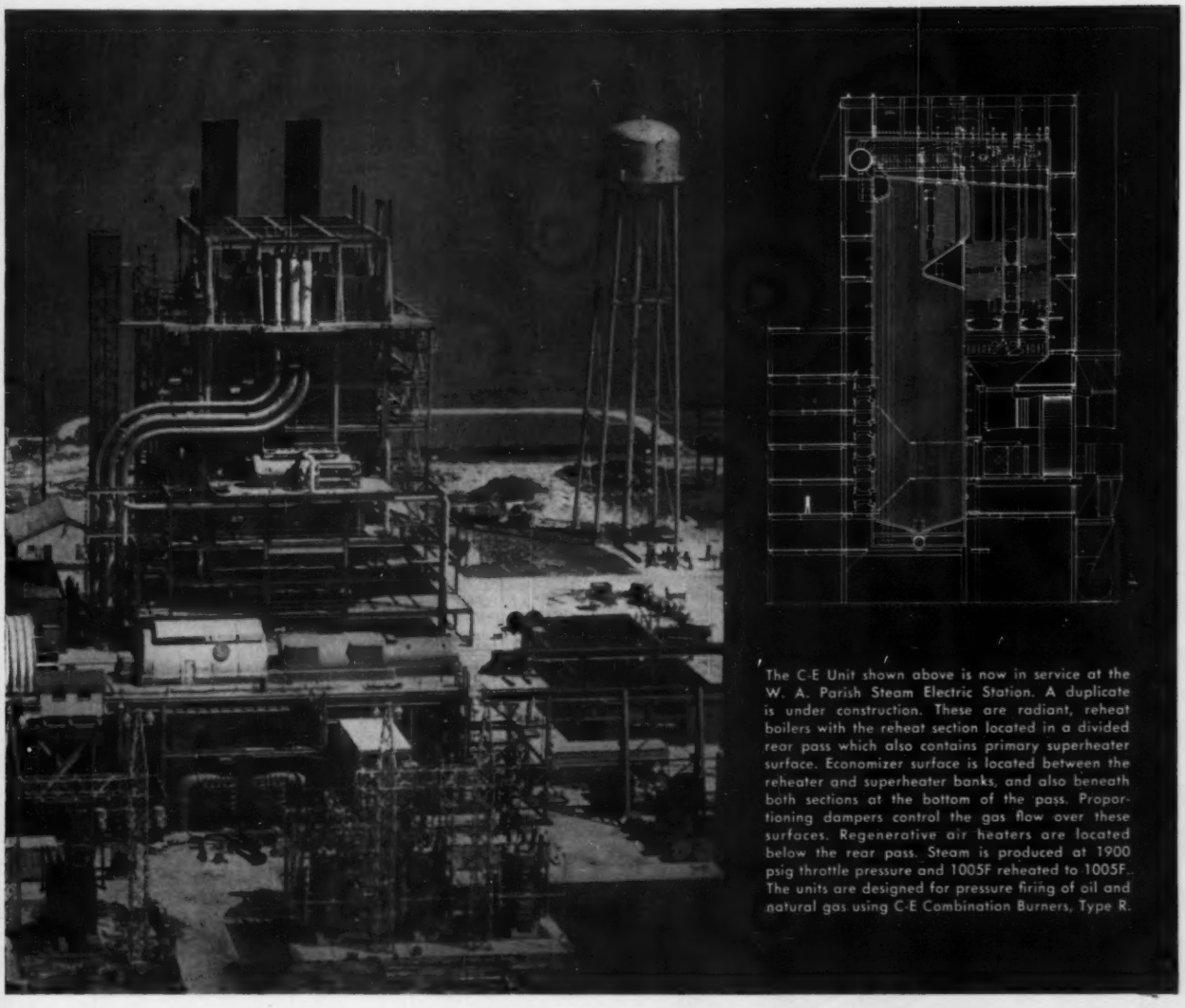


New W. A. Parish *Goes*

The first generating unit of the new W. A. Parish Steam Electric Station of the Houston Lighting & Power Company has recently been placed in service.

Located at Smithers Lake, some 9 miles south of Sugarland, Texas, and about 13 miles from Houston city limits, this new plant—one of the largest in the area—was named in honor of Mr. W. A. Parish, President of the Company from 1953 to 1958, and now Chairman of the Board of Directors.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED



The C-E Unit shown above is now in service at the W. A. Parish Steam Electric Station. A duplicate is under construction. These are radiant, reheat boilers with the reheat section located in a divided rear pass which also contains primary superheater surface. Economizer surface is located between the reheater and superheater banks, and also beneath both sections at the bottom of the pass. Proportioning dampers control the gas flow over these surfaces. Regenerative air heaters are located below the rear pass. Steam is produced at 1900 psig throttle pressure and 1005F reheated to 1005F. The units are designed for pressure firing of oil and natural gas using C-E Combination Burners, Type R.

steam electric station

into service

The first generating unit—now in service—is rated at 156,250 kw, and the plant will eventually have more than 1-million kw installed capacity. A duplicate unit is presently under construction. Ebasco Services, Inc. are the consulting engineers.

Both of the W. A. Parish station's turbine generators are served by C-E Steam Generating Units, a cross-sectional elevation and brief description of which appear above, right.

COMBUSTION ENGINEERING

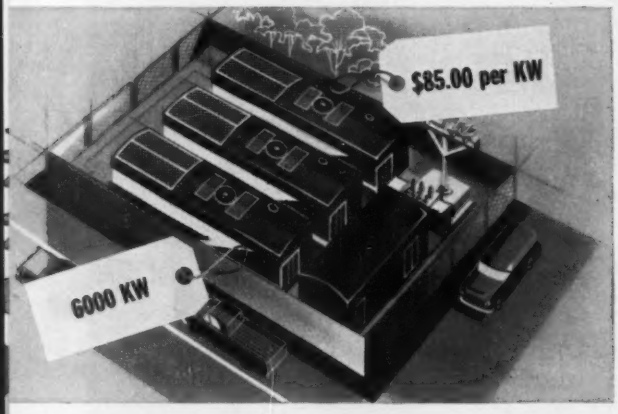
C-171

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

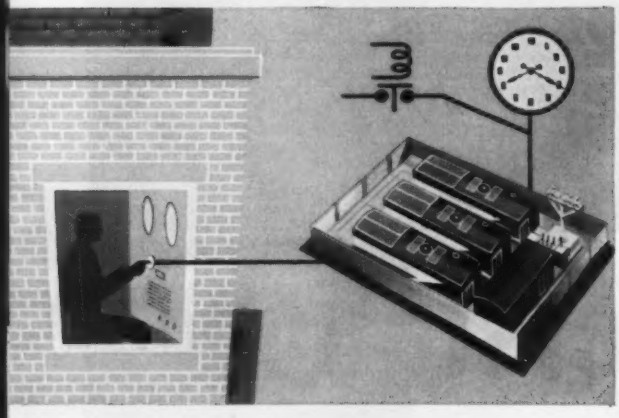
Electro-Motive 6000 KW

Product facts for your peaking plans—



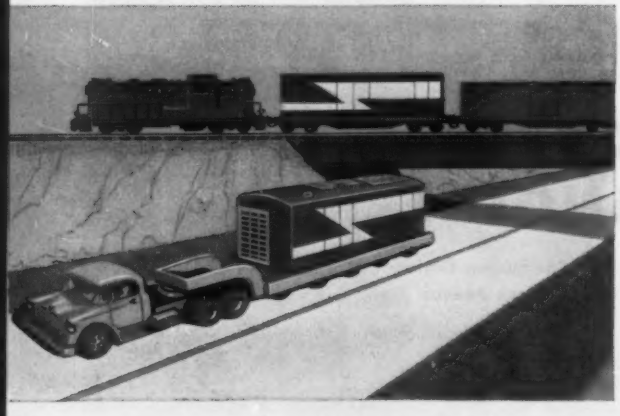
6000 KW at $85.00 per KW*

To perform economically its intended function, peaking equipment must naturally be low in original cost. Electro-Motive equipment meets this cost requirement. *F.O.B. Factory.



Unattended operation

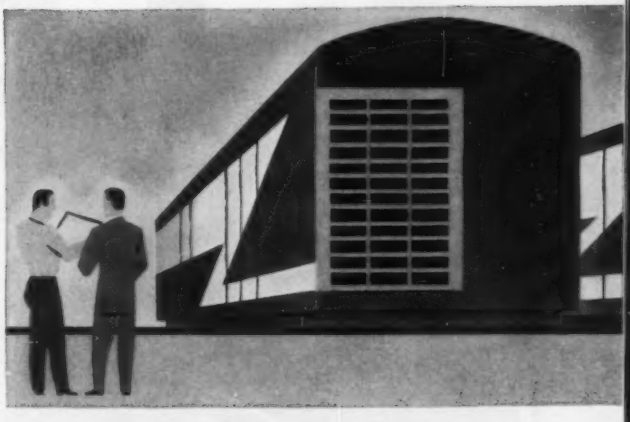
The 6000 KW Peaking and Reserve Plant operates completely unattended. An electrical impulse is all that is needed—from a time clock, dispatcher, current or voltage sensing equipment or a combination of these methods.



Readily transportable

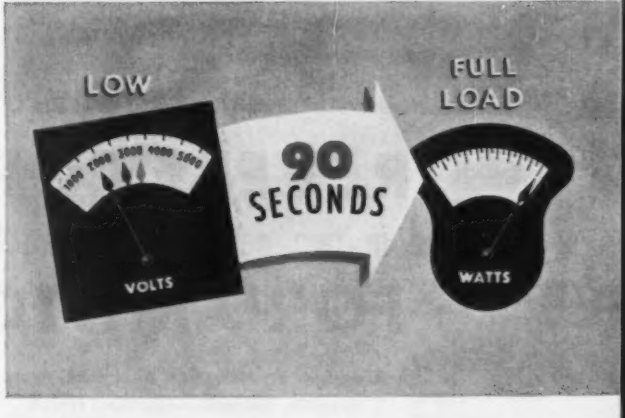
The Electro-Motive Peaking and Reserve Plant is handled much the same way as many transformers. Components are shipped on standard rail cars or highway equipment.

Peaking and Reserve Plant



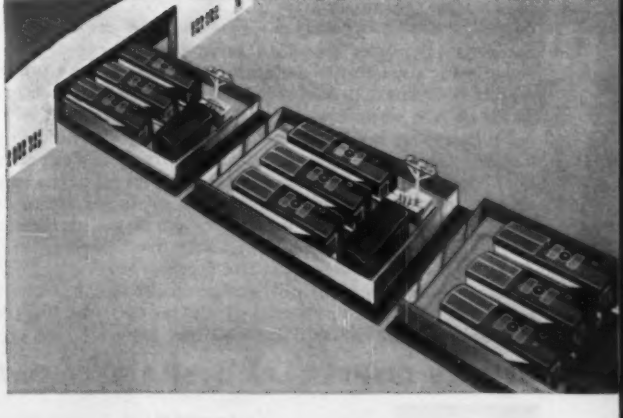
Quiet operation

Silencing arrangements are included to fit the varying conditions under which Electro-Motive Power must operate. Thus considerable freedom can be exercised in location of the equipment.



Quick start

The Electro-Motive Peaking and Reserve Plant starts instantaneously. In a matter of seconds it is on the line at full rating, thus fulfilling the requirement for spinning reserve.

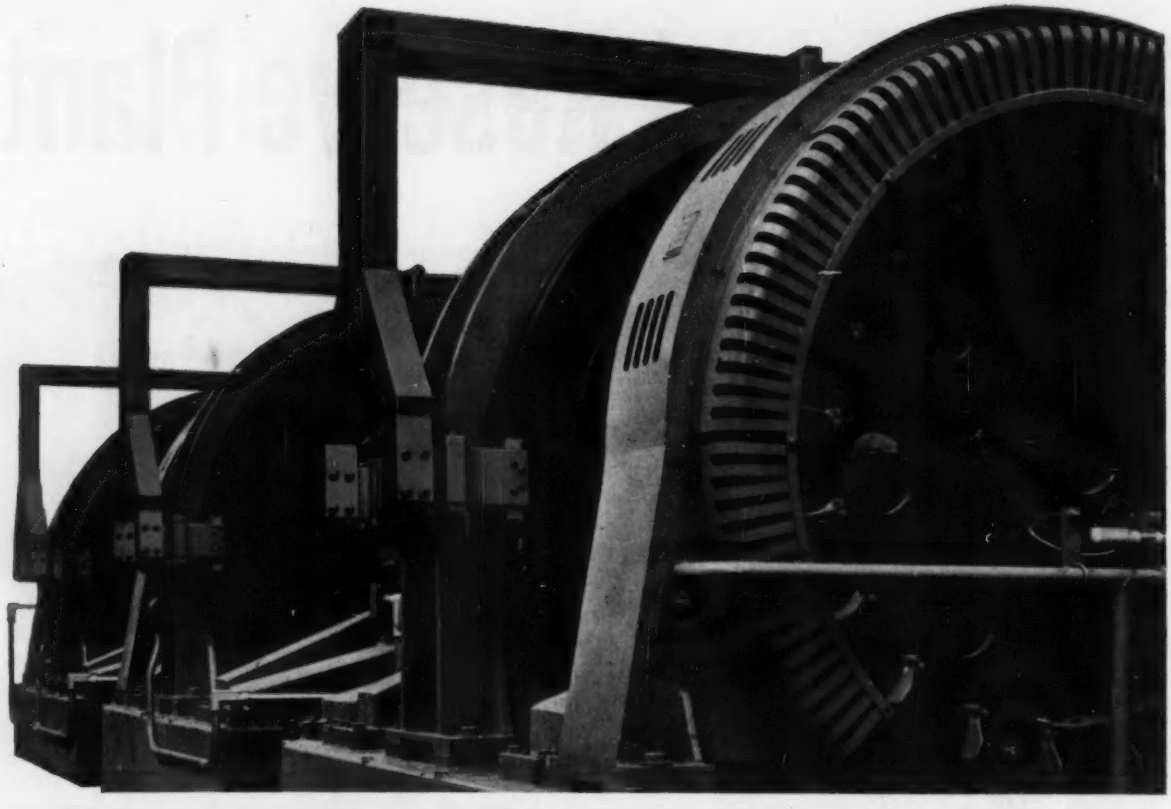


One manufacturer

Electro-Motive Peaking Plants are designed, engineered, manufactured and serviced by Electro-Motive. There is only *one* manufacturing responsibility for the complete plant—starting from fuel input to power output.

ELECTRO-MOTIVE DIVISION · GENERAL MOTORS

LA GRANGE, ILLINOIS **Sales-engineering offices:** Chicago, New York, St. Louis, San Francisco *In Canada:* **General Motors Diesel Limited,** London, Ontario



REVERE COPPER BUS BAR

used in two new 700-ft. long Udylite Bumper Plating Machines at

FORD MOTOR COMPANY

Aids in the production of a new, more durable, corrosion-resistant finish

Said to be the world's largest, the two Udylite plating machines are capable of turning out, per machine, 35 racks of bumpers an hour through 10 stages of a 3½ hour plating cycle. The electro-plating installation uses eighty generators, varying from 5,000 to 20,000 amps, which combined, provide enough power to light more than 150,000 bulbs of 100 watts each.

To carry that kind of a load from generator to plating machine, Revere Copper Bus Bar was used because of copper's superior electrical and heat conductivity. No other commercial metal of the same cross-section area approaches electrolytic copper in its ability to carry electricity, while its high thermal conductivity offers the greatest ease of cooling. This means a more compact installation with a resultant saving in space. Also, joints of high electrical conductivity are readily made by soldering, brazing or bolting. For information on Revere Bus Bar, as well as other Revere copper and brass mill products consult the nearest Revere Sales Office. You'll find it listed in the yellow pages of the telephone directory.

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Rome, N.Y.; Baltimore, Md.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Brooklyn, N.Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities, Distributors Everywhere.

RACK OF BUMPERS ready for immersion into plating solution at Ford Motor Company's plant at Monroe, Michigan. New process uses copper, white brass, nickel and chromium which results in outstanding durability.

The Electrical Week

FUTURE NEWS ▶ **A big eastern utility will build a "base load" transmission line** to withstand the once-in-40-years kind of weather catastrophe, typified by last spring's ravaging snow and sleet storm.

Army's attempt to put teeth in "Buy American" Act will succumb to State Dept pressure—that's the guess of informed observers.

LATE NEWS ▶ **California's Board of Equalization temporarily rules** against levying a tax against Pacific G&E on its purchase of power from the publicly-owned Tri-Dam Project in Central California.

Public Service of New Hampshire asks PUC for an estimated $600,000 a year rate increase . . . Sterling, Mass., Municipal Electric Light Dept gets approval to increase rates 10% . . . Iowa P&L ups residential rates 7% and commercial 9% in Des Moines.

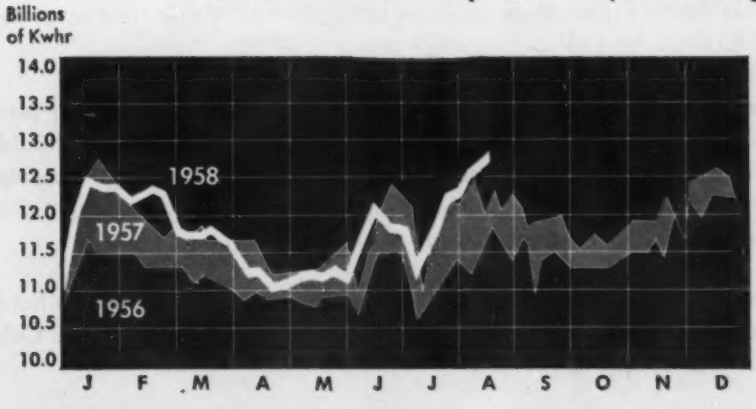
Platform adopted by California Democratic State Convention includes demand for a complete restudy of PUC regulations in the state.

Real property owned by an electric co-op is subject to regular assessment and taxation, South Dakota Attorney General Philip Saunders rules . . . Moorhead, Minn., City Alderman Richard Knapp proposes a $1 monthly tax on electric meters in the city.

Major appliances showed sales gains for second consecutive month, according to preliminary NEMA figures for July. Scores: Built-in ranges soared 28% over July '57; dishwashers up 19%; freezers up 9%.

Five of eight IBEW locals of Alabama Power Co turn down 5% wage hike, saying it was inadequate "but we will make every effort to settle our differences without a strike." Long Island Lighting and IBEW agree to 5% increase . . . 5% agreed on also by IBEW and Eastern Shore Public Service Co.

POWER OUTPUT—Up 3.6% (Week ending Aug. 16), Kwhr 12,851,000,000



Per Cent Change From Previous Year

	Aug 2	Aug 9	Aug 16
Total U.S.	+1.2	+5.3	+3.6
New Eng.	+2.5	+5.1	+5.3
Mid. Atlantic ..	+3.9	+5.5	+7.0
Cent. Ind.	−3.1	+2.7	+1.7
West Cent.....	−7.2	+7.7	+3.4
Southeast	+6.3	+7.0	+3.6
South Cent. ...	+5.9	+14.8	+7.9
Rocky Mount...	+5.6	+4.7	+6.2
Pacific			
NW	−11.9	−10.9	−8.8
SW	+3.0	+6.6	+4.6

Seasonally Adjusted Index 238.9

Week Ago 237.4 Year Ago 232.1

Source: Edison Electric Institute

A TWO-MINUTE PREVIEW OF THIS ISSUE

EVENTS ▶ **Despite lagging industrial sales, new output highs** were reached in a hot week ending Aug. 16. Output totaled 12,851-million kwhr, and the seasonally-adjusted index hit 238.9. . . . Hydro operators, who have enjoyed generally good water conditions, will be interested in watershed clearing tests (p 52).

Ten electric industry executives are now in Russia on a 16-day tour of Soviet power stations and electrical equipment plants. Here is first on-the-spot report (p 56).

Power companies will have their say on the IRS ruling concerning ECAP advertising. Internal Revenue Service will hold a hearing at an undisclosed date, and Federal Power Commission has scheduled one for October 7 (p 56).

A ticklish closure of Oahe Dam was moved up 12 hours to beat high water, then carried out smoothly (p 55).

SUBSTATIONS ▶ **The accent is on substations** in these four articles from the field covering design, operations, and maintenance.

First 345-kv substation in the Chicago area, at Goodings Grove, Ill., links Commonwealth Edison Co's 138-kv system with a 345-kv tie to American Electric Power Co. Ultimate plan calls for six 345-kv and eight 138-kv lines. The substation is unattended, controlled over leased telephone lines. Details are on p 58.

To limit circulating current in paralleled regulators feeding a common load, Detroit Edison Co has developed three new regulator control circuits: One for current balancing, one for voltage balancing, and one to provide regulators with equal compensation without excessive circulating current. These circuits are explained and diagrammed on p 62.

How much overload can your voltage regulators take? Here's what to watch for when figuring a safe overload, guides that can be used, and how overloading affects insulation life (p 64).

Special racks and carts simplify bushing handling at Houston Lighting & Power Co substations. Story and pictures of this time saver on p 64.

GENERATION ▶ **What's the best way to compare power plants?** An engineer-professor suggests that our station thermal performance criteria should be based on low heating value of the fuel rather than high heating value. This would give gas- and oil-fueled plants a chance to get the recognition they deserve (p 72).

INDUSTRIAL ▶ **Oil and insulation require vigorous preventive maintenance** to hold equipment downtime to a minimum. Here's West Penn Power Co's

formula for insulation testing, as recommended to a group of its industrial customers through a recent Substation Maintenance Workshop. Acceptable test values are included, as well as instructions on how to get accurate readings on dielectric strength, acidity, and other tests (p 69).

MANAGEMENT ▶ **Electric companies rate high with the public,** according to a recent survey conducted by Opinion Research Corp. A national population sample said that power companies did the "best job of holding down prices" among 16 industries, rated them favorably in employee relations. Here's the industry profile, and also a picture of one company's "corporate image" (p 99) . . . Iowa-Illinois G&E promotes area development with a business newspaper for its bi-state territory, aims to impress ten small cities that they are "interdependent, economically and socially" (p 102).

SELLING ▶ **Production costs were slashed** when U.S. Envelope Co's White Corbin Div converted to purchased power for its d-c machines. A modern rectifier was purchased and the old d-c plant shut down, freeing five mechanics and over 3,000 sq ft of floor space. The new set-up also assures more dependable operation (p 94).

No recession in deep fat fryers was apparent as Union Electric Co wound up a 13-week promotional campaign. Aimed at the commercial market, the campaign sold 1,582 kw of fryers and other cooking equipment (p 90).

MANUFACTURERS ▶ **Substation enclosures don't have to look like fences.** They can be designed to harmonize with neighborhood surroundings . . . Universal angle bus conductor is now available as a low-cost substitute for smaller sizes of tubular bus conductors . . . Copperweld Steel Co will build a new plant at Glassport, Pa., for its Alumoweld wire and strand . . . Motorola has developed a transistorized two-way mobile radio (p 74).

NEW EQUIPMENT ▶ **Fiber glass hotstick has longitudinal lay-up** of glass fibers to prevent splintering or snapping. The stick has zero water absorption, dielectric wet strength of 150 kv per ft . . . Neutral compression splice can be used for short-span ACSR and all-aluminum messenger neutrals, as well as service entrance triplex (p 80).

PEOPLE ▶ **Canadian Electrical Assn's new president is V. A. Ainsworth,** general manager, Newfoundland L&P . . . Potomac Electric Power has named J. C. Herbert manager-purchasing and general services and A. E. Stant purchasing agent . . . A. M. Ziegler has been elected vp of Rome Cable; and Leonard Broder is Royal Electric's new vp-marketing (p 106).

Technical knowledge is only one aspect of the problems continually facing the engineer. The other is the economic one. The new third edition of a book entitled "Engineering Economy" gives the practicing engineer an insight into this second aspect. The book provides three separate but related analyses—the economy analysis, the intangible analysis, and the financial analysis. They are concerned with practicability, judgment and provision of necessary funds. The third edition provides new cost data and a discussion on effect of state and federal taxes. This book can serve as both an introduction and reference volume to those interested in this very important subject.—**Engineering Economy, Third Edition. By Clarence E. Bulinger. Published by McGraw-Hill Book Co, 330 West 42nd St, New York 36, N. Y. 366 pages, illustrated. Price $7.00.**

TECHNICAL NOTES

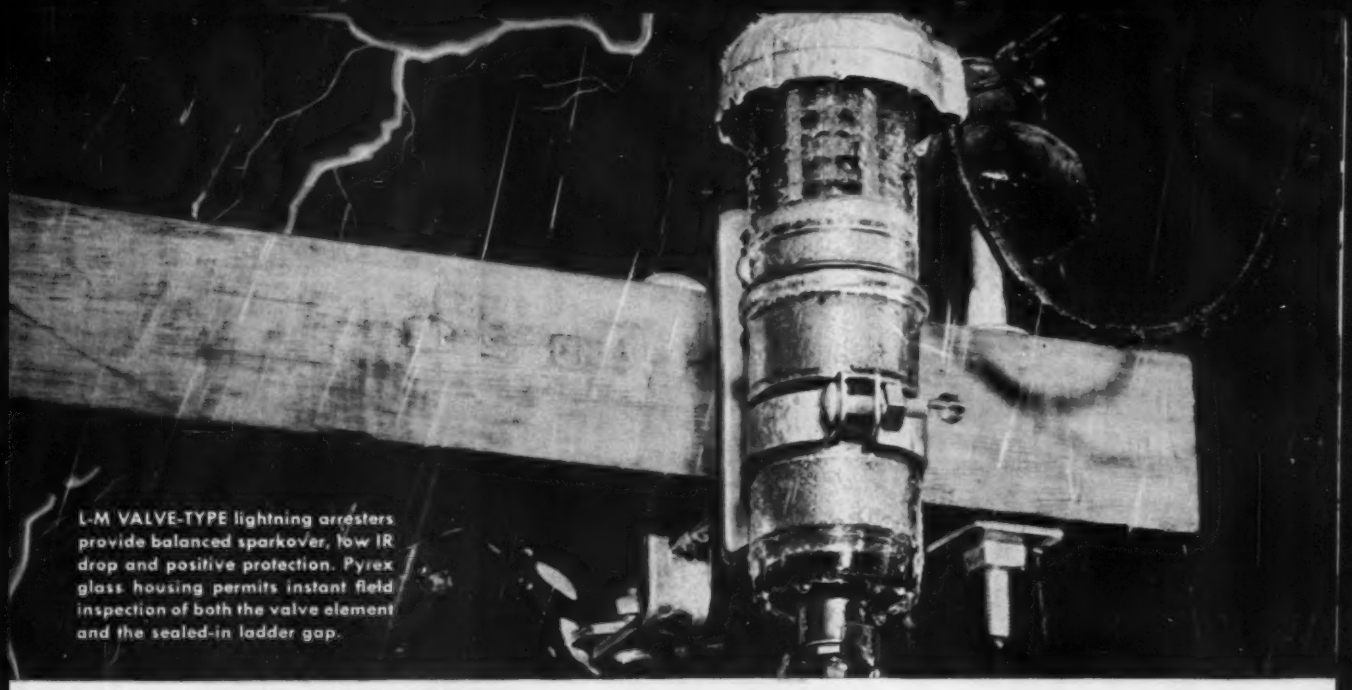
Atomizing oil-fired furnaces with natural gas instead of steam reduces costs. Substitution of natural gas with its exothermic reaction, for steam with its endothermic qualities means greater heat input per hour and higher flame temperature. Method has been used successfully in steel industry.

False differential currents in transformer differential relays will be greatest when external faults cause one main current transformer to saturate completely and the other main current transformer not to saturate at all.

Solvent de-salting process for converting sea water to fresh water is especially promising because of low cost. Solvent and sea water are brought together at room temperature; water dissolves into the solvent, leaving the salt. After heating water-solvent mixture for separation, solvent can be re-used.

FROM EDITORS IN THE FIELD

Experience at Calder Hall has shown that the plutonium produced was partially converted into non-fissionable higher isotopes giving the by-products as a whole a lower market value.



L-M VALVE-TYPE lightning arresters provide balanced sparkover, low IR drop and positive protection. Pyrex glass housing permits instant field inspection of both the valve element and the sealed-in ladder gap.

Now It's 12 Years . . .

And This Utility's Performance Record On L-M Valve Arresters Is Even Better!

For 12 years now, a large midwestern utility company has kept accurate performance records on L-M valve-type arresters. And even though, year after year, the number of arresters increases, Isolator operations remain fairly constant.

At the end of 1956, latest year for which records are available, the company had in service 29,300 L-M valve arresters, representing a total of 167,410 arrester service years.

During this entire period there were 59 Isolator operations, disconnecting a faulted arrester from the line. Out of 2349 L-M arresters removed from service because of system changes, and then tested, not a single arrester failed in the tests.

Glass Housing Permits Visual Inspection

Outstanding features of L-M arresters helped make this remarkable record possible. With L-M's exclusive Pyrex glass housing, arresters can be visually inspected right on the pole. Any potential failure is instantly apparent. This eliminates unexplained fuse blowings because of an arrester that has failed or is about to fail on the next surge. This inspection is, of course, not possible with a porcelain-housed arrester that could be put on the line and fail at the next surge.

Isolator Added Insurance Feature

The Isolator, an L-M patented insurance feature, instantly disconnects the arrester from the ground in case of failure. Thus L-M valve arresters will not lock-out feeders, even in the rare cases of failure. In the case of this utility, the 59 Isolator operations prevented 59 cases of feeder lock-out.

Get This Free Bulletin

Ask the L-M Field Engineer for Bulletin LA-2, which gives details on L-M valve arrester design and characteristics. Or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

Here are the records for the years 1945 through 1956

Year	Arresters In Service	Isolator Operations In Service	Arresters Tested	Arresters Failed In Test
1945	3,286	5	0	0
1946	4,322	2	11	0
1947	6,020	2	137	0
1948	7,469	4	118	0
1949	8,686	3	186	0
1950	11,392	7	161	0
1951	13,950	3	270	0
1952	15,282	7	204	0
1953	20,498	13	158	0
1954	21,105	2	383	0
1955	26,100	3	245	0
1956	29,300	8	476	0
1957	*Records not yet available*			
Total Arrester Service Years: 167,410		59	2,349	0

59 ÷ 167,410 x 100 = .0352% failure rate

360

McGRAW EDISON

LINE MATERIAL Industries Lightning Arresters

McGRAW-EDISON COMPANY

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

"X-RAY" VIEW of the SRT, showing the volt-sensitive regulating mechanism at the top of the core-coil assembly and the under-load tap changer at the lower part. SRT's will be available in the following ratings:

2400 volts, 10 through 25 kva
4160 volts, 10 through 37½ kva
4800 volts, 10 through 50 kva
7200 and 7620 volts, 10 through 75 kva
12,000 and 14,400 volts, 10 through 100 kva

L-M Announces the

SRT

THE WORLD'S FIRST

Self-Regulating distribution Transformer

A Revolutionary New Engineering Development That Offers Utility Companies Better Revenue, Better Service To Their Customers

By **A. R. WAEHNER**
Director, Transformer Sales, Line Material Industries

The new L-M Self-Regulating Transformer consists of a Round-Wound® distribution transformer with extra taps on the *primary*, and a regulating mechanism that is volt-sensitive on the *secondary*.

The device switches primary taps, *under load*, to change the transformation ratio as needed to maintain a constant normal voltage to the customer, regardless of line or load changes. The SRT provides 10% of regulation in four 2½% steps.

Better Revenue For The Utility

The SRT is a break-through into a whole new world of customer service and profitable operation, because it corrects the voltage *at the point of use*. By maintaining proper voltage, the SRT prevents the drop in billings caused by *undervoltage*, which in the aggregate can represent a considerable loss.

Improves Service To Customers

With correct voltage, lights are brighter; television sets, clothes dryers, air conditioners, and other electrical devices operate more efficiently; ranges heat faster.

The SRT also prevents *over-voltage* from reaching the user. This greatly reduces burnouts of TV tubes, and of incandescent lamps—the latter a very obvious saving to a utility with a lamp-replacement program.

The SRT is another outstanding contribution of The Thomas A. Edison Laboratories of McGraw-Edison Company.

Features Of The SRT

Adapt-a-Tap Range Selector: The SRT provides a full 20% range within which taps for the 10% automatic regulation in four 2½% steps may be selected—all below, straddle, or all above normal. Thus the SRT can be located anywhere on the line—the end, the middle, or near the substation.

Nominal 3½-Volt Band Width: The midpoint is set, for example, at 120 volts. The SRT changes taps whenever the voltage drops to 118¼ or rises to 121¾. Each operation occurs only after a time delay, which prevents undesirable operation and "hunting" on switching surges and momentary variations outside the band width.

Reliability: One 2400-volt tap changer has now operated more than 250,000 times—equivalent to over 40 years' life on a 25 kva transformer.

Economy: Under normal conditions the SRT will prove more economical than other means of voltage correction. Thus it opens unlimited horizons to the distribution-system planning engineer for more effective design.

Available For Tests

The initial production of the SRT will be sold to progressive companies to explore the benefits, in improved revenue and better customer service, that are available from this outstanding new development. Thus each company can learn, for itself, the extent to which the SRT can make a substantial contribution toward keeping revenue up and costs down.

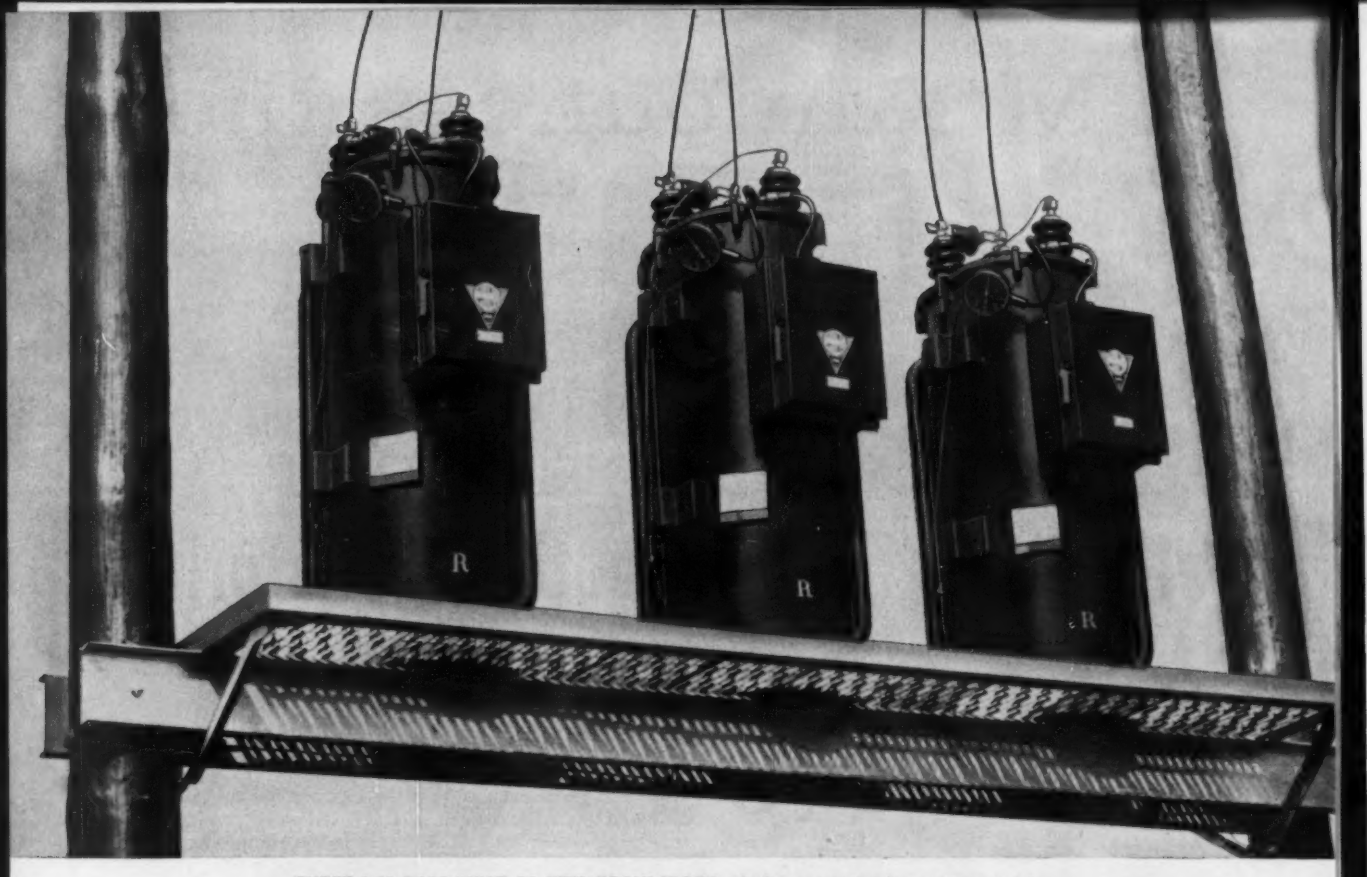
Get The Details

L-M Field Engineers and Apparatus Specialists can furnish detailed information about the SRT. If you would like this information, please get in touch with your L-M Field Engineer, or phone or wire me at Line Material Industries, Milwaukee 1, Wisconsin.

LINE MATERIAL Industries
McGRAW-EDISON COMPANY
Distribution Transformers

McGRAW EDISON

350



THREE L-M 7620 VOLT 32-STEP REGULATORS, platform mounted, are in a circuit serving cotton gins and other customers where accurate regulation is a necessity.

6 Reasons More and More Utilities Are Selecting L-M Step Regulators

Pole-space saving, obround tank with less bending moment, cover suspension, tap changer, easily adjusted accurate control, and Add-Amp feature are some of the reasons why utilities throughout the country are selecting L-M regulators.

The L-M 32-step regulator includes the desirable features of all distribution-type regulators in one complete unit. Several of these features are:

1 The L-M regulator, because of its short height, takes less pole space.

2 The obround tank makes L-M regulators lighter, more compact. They hug the pole, which results in lower bending moment.

3 Cover suspension of the entire internal assembly facilitates inspection and maintenance.

4 The unusually rugged tap changer, with hydraulic speed control for optimum contact life, provides regulation in smooth ⅝% steps.

5 The L-M Add-Amp feature gives increased load-carrying ability where less than ±10% range of regulation is satisfactory.

6 The control, with induction disc type contact-making voltmeter and Class I accuracy, has simple adjustments for voltage level, band width and line drop compensation. Taps can be changed on ratio correcting transformer in control cabinet, for reduced voltage operation, *without* untanking of regulator.

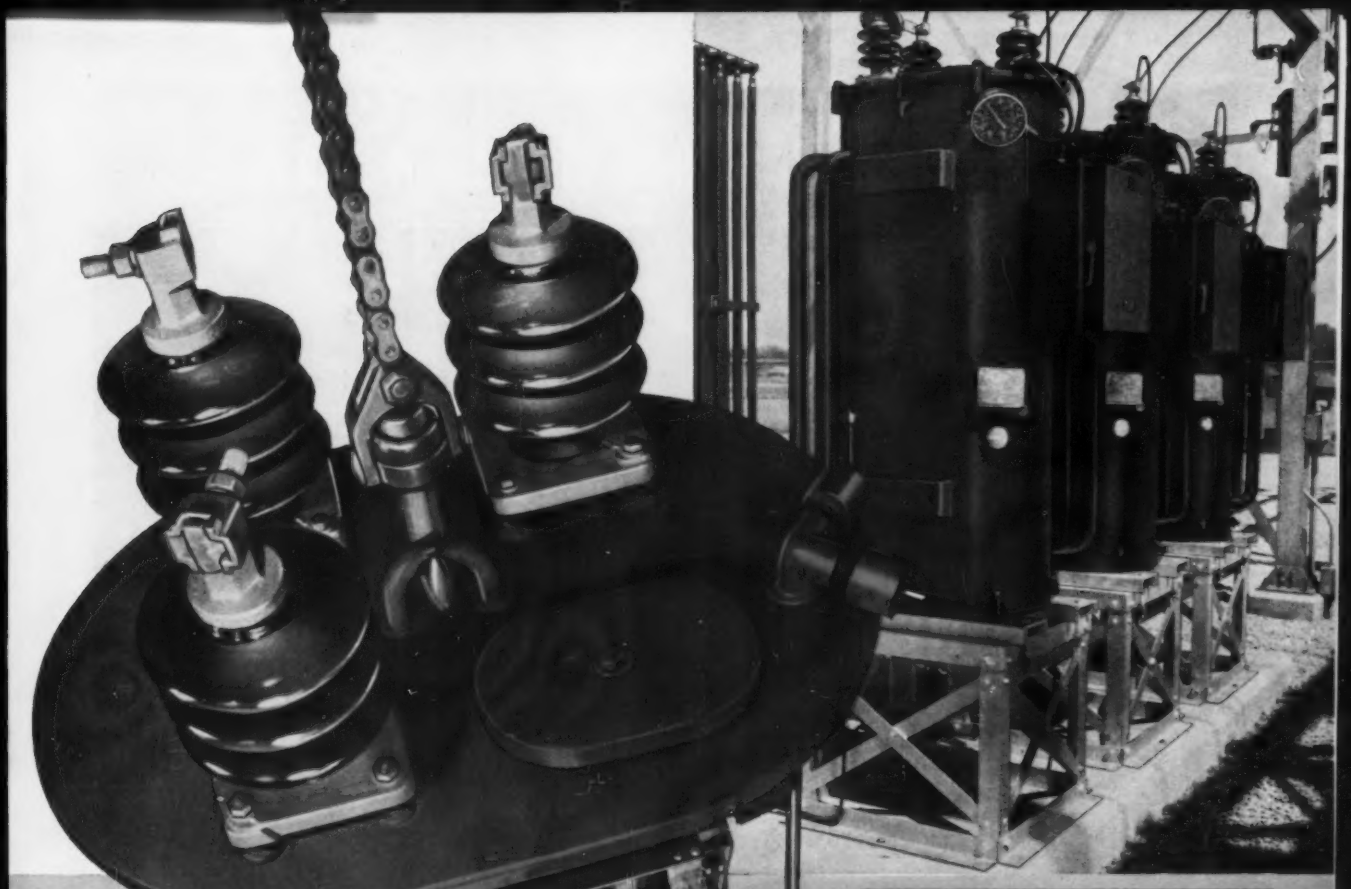
Many other features combine to make this a most desirable regulator, which many utility men consider superior to anything else on the market. No other regulator offers so many advantages in one single unit.

Ask the L-M Field Engineer About It

The L-M Field Engineer can provide complete information and bulletin on the application and design of L-M regulators. Or write for bulletin to Line Material Industries, Milwaukee 1, Wisconsin.

LINE MATERIAL Industries

McGRAW-EDISON COMPANY



A SUBSTATION INSTALLATION of three 7620 volt regulators. L-M regulators are presently available in these ratings: 2.5 kv, 100, 150, 200 amps; 5 kv, 50, 100, 150, 200 amps; 7.62 kv, 25, 50, 75, 100, 150 amps.

THE COMPLETE INTERNAL ASSEMBLY is cover-suspended to simplify untanking. This desirable feature permits quick, easy inspection of all mechanical and electrical parts, without dismantling the unit or draining the oil.

THE L-M REGULATOR is light, small, compact. This and the obround tank make the L-M regulator very desirable for pole mounting, because of the reduced bending moment on the pole. The L-M regulator is as much as 21 inches shorter than other regulators; thus it takes less pole space.

Regulators

McGRAW EDISON

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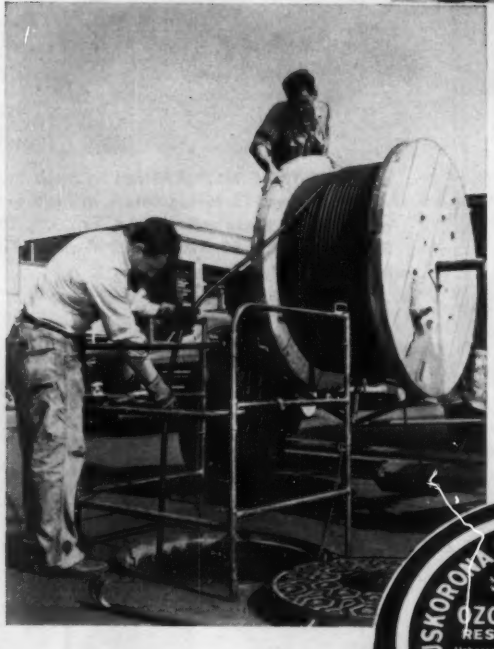
DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

TAPE IT for durability with



USKORONA

the only tape that resists both moisture and ozone

Uskorona tape will *not* break down. Just how rugged is this tape? Well, in a corona-(ozone) resistance test of 4 leading brands, Uskorona was the only tape still intact after 4 hours of exposure. All others broke down. Even after 1500 additional and *consecutive* hours of exposure, Uskorona remained as fresh and corona-resistant as at the start.

Electrical engineers insist on Uskorona in the design, installation, operation and maintenance of power lines wherever corona or moisture is a problem. Uskorona provides ideal insulation in splicing electrical cables on underground power lines, on secondary network systems, underground street lighting circuits, and transformer leads. It fuses with and becomes a part of the insulation and gives the *same* dielectric strength as the original insulation. Exceeds A. S. T. M. specifications.

• • •

When you think of rubber, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

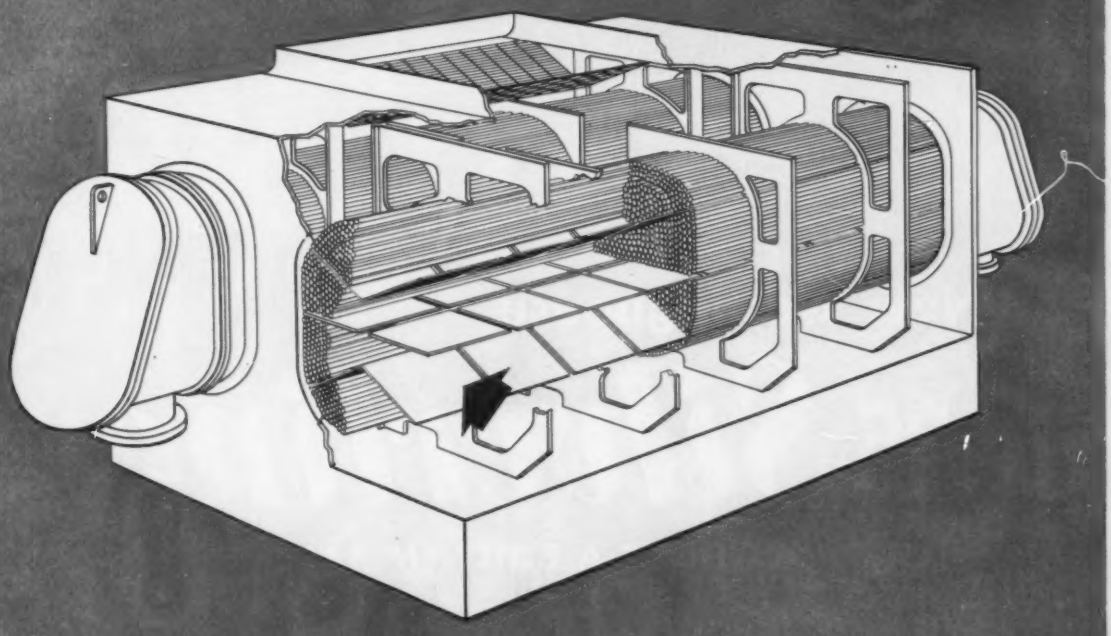
Mechanical Goods Division

United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

unique location of condensate removal trays produces most effective deaeration and higher vacuum



Another Big Difference in

ROSS SURFACE CONDENSERS

Innovations in Ross Surface Condenser design are numerous. Each provides distinct advantages.

Arrangement of the condensate trays in the 110,000 sq. ft. unit illustrated is a noteworthy example. They perform a triple service:

1 By spilling the condensate into the live steam transportation area, the trays promote effective deaeration in the main shell. Droplets are thoroughly scrubbed with live steam. Entrained non-condensibles are then released and swept into the air removal section.

2 As a result of their converging pattern, the trays maintain vigorous steam velocities for scavenging non-condensibles.

3 By reason of the trays' effective draining action, water-blanketing or flooding of the tubes is minimized. *All* tube surface in the bundle therefore condenses steam at top efficiency, with uniform heat transfer over the entire bank.

Keep your eye on the Ross design. It's packed with benefits found in no other condenser. Discuss them with a Company representative at your convenience ... and request Bulletin 8.2K1 now.

American-Standard*, Ross Heat Exchanger Division, Buffalo 5, N. Y. In Canada: American-Standard Products (Canada) Limited, Station D, Toronto, Ont.

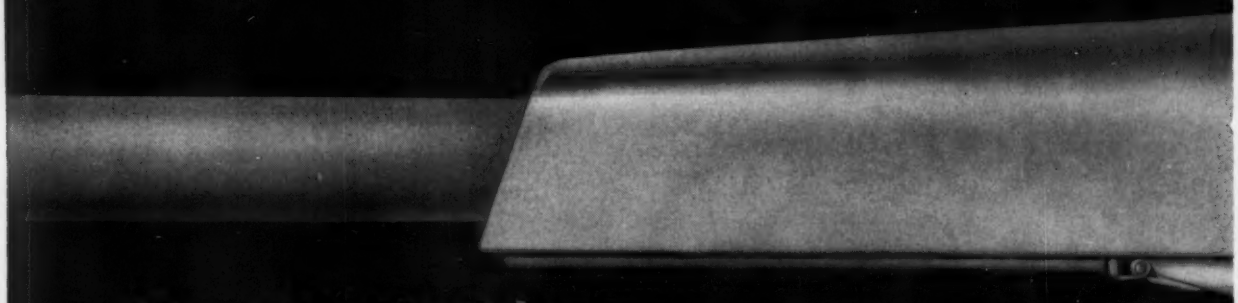
*American-Standard and Standard ® are trademarks of American Radiator & Standard Sanitary Corporation.

American-Standard Products

AMERICAN-Standard

ROSS HEAT EXCHANGER DIVISION

OBSOLETES ALL PREVIOUS

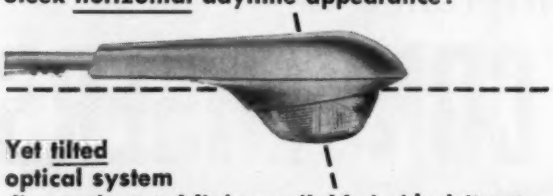


New Westinghouse

OV-25 *Silverliners*

WITH OR WITHOUT A BUILT-IN BALLAST

Sleek horizontal daytime appearance!



Yet tilted optical system directs the total light available in *ideal* distribution patterns. Gives more light per watt than any other comparable luminaire!

A roadway luminaire establishing new standards of design, application and cost-saving is now available from Westinghouse!

This new luminaire is the OV-25 *Silverliner.* It is engineered to virtual optical perfection! With features producing "custom application" of maximum lighting output—for practically all roadway areas requiring high illumination!

A one-piece *die-cast* aluminum housing permits the clean-lined Silverliner styling that heightens community pride—and gives Silverliners an almost unlimited service life!

Silverliner reflectors of Alzak® finished aluminum are contour-engineered precisely for the 400-watt mercury lamp—the most economical lamp for roadway lighting today! These reflectors snap rigidly into the housing in positive alignment!

Silverliner prismatic refractors achieve new excellence in the optimum control of total light output! And their edge overlaps the edge of the reflector—"uniting" the two—and eliminating the trapping and the waste of light that occurs at this juncture in all other designs!

Then the die-cast aluminum refractor ring automatically "locks" the reflector-refractor assembly into precise, tilted optical focus!

Moreover, a resilient seal at the socket-opening, as well as at the reflector-refractor gasket, prevents the entry of bugs, dirt or moisture. The need for cleaning is minimized. As a result, this "double" sealing of Silverliners produces more *maintained* light than is *possible* by other luminaires, with openings around their socket!

Finally, Silverliners give either Type II or Type III distribution. And a simple socket adjustment lets you "toe-in" the beam! You can "custom focus" the light from *each* Silverliner, according to its location!

Silverliners first *deliver* and then *maintain* more light per watt—with optimum roadway coverage—than *any* other 400-watt luminaire available today!

400-WATT LUMINAIRES

Built-in Ballast model saves from $50 to $70 on every Silverliner installed!

With their own dual-voltage regulated output ballasts self-contained, Silverliners eliminate need for:

1—Transformer bases
2—Pole-top fitters
3—Mounting bands
4—All labor for their assembly
5—Often, considerable wire
6—Splicing time and labor

And, all installation and servicing from one ladder-position—*and from below*—creates additional savings!

Silverliner housings are merely mounted level. Tilted optical system alignment is automatic. Only two leads go to the terminal block. Installation time is cut as much as 60 per cent!

Maintenance costs cut up to 30%

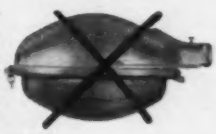
The refractor-ring hangs open for easy access to the lamp. It is secure in open position but easily removed. And Silverliners' *completely* sealed optical system can cut the number of cleaning trips in *half!*

Call your Westinghouse Representative TODAY! Get your FREE Silverliner brochure. See, for yourself, the *startling* savings you get with Silverliners!

Or, write directly to Westinghouse Electric Corporation, LIGHTING DIVISION, Edgewater Park, Cleveland, Ohio.

J-04461

1947 This first luminaire for horizontal-burning mercury lamps, introduced by Westinghouse, had a one-piece reflector-housing. It excelled at the time; but was discontinued because reflector-housings:



1 Require longer periods atop ladders for servicing. Make maintenance slow and costly!

2 Do not assure a positive seal. Need more frequent cleaning. Have high loss of efficiency!

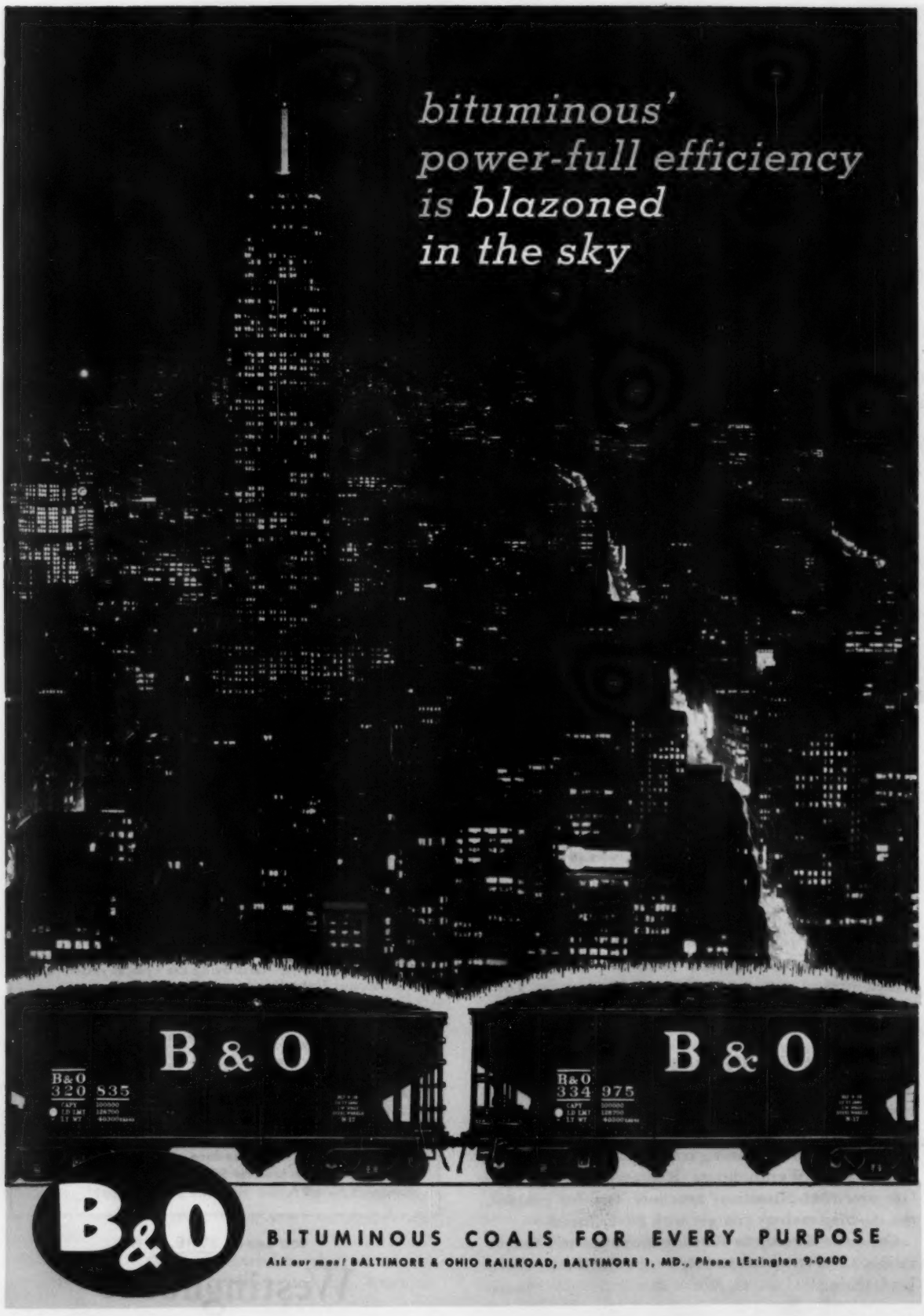
3 Are easily dented—destroying the optical system and distorting light distribution!

1953 This first luminaire with a cast-aluminum housing and separate reflector was also introduced by Westinghouse. It vastly improved lighting efficiency, gave excellent maintained-light and cut maintenance costs!

1958 **New Silverliners with their tilted optical system now offer you a more modern appearance and increased efficiency. Look for Silverliners to establish new standards for all future roadway illumination!**

YOU CAN BE SURE...IF IT'S

Westinghouse


bituminous'
power-full efficiency
is blazoned
in the sky
B & O
B&O 320 835
B & O
B&O 334 975
B&O
BITUMINOUS COALS FOR EVERY PURPOSE
Ask our man! BALTIMORE & OHIO RAILROAD, BALTIMORE 1, MD., Phone LExington 9-0400

From Westinghouse Plowback of Earnings into Research...

FAULT INTERRUPTING CAPACITY FOR TOMORROW'S SUPER-POWER SYSTEMS

Building upon generations of experience in the High Power Lab, Westinghouse engineers have expanded the heavy-fault-interrupting capacities of breakers of 69 kv, 115 kv, 138 kv, 161 kv, 230 kv and 345 kv.

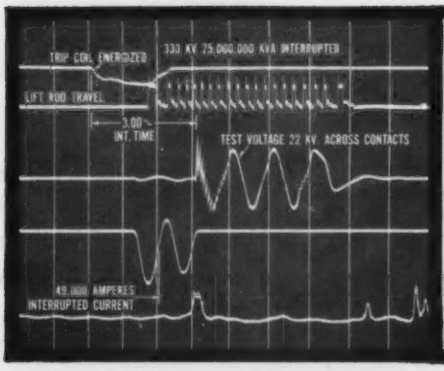
The fundamental techniques of arc deionization developed by Dr. Slepian at Westinghouse led to the present multi-break grid design that brought to the industry circuit breakers with capabilities to interrupt 10-, 15- and 25-million-kva faults. Several well-known cooperative studies have already proved the feasibility of raising system voltages and power concentrations even further.

Westinghouse power circuit breaker designers say that the still higher interrupting capacities needed can be developed with refinements of their basic De-ion® grid. Whatever the industry's requirements in protective equipment to handle the rapidly growing power loads, Westinghouse will continue to provide circuit breakers . . . in advance of their need!

For further information and a copy of the informative Circuit Breaker Handbook, B-7232, call your Westinghouse sales engineer. Or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-60961

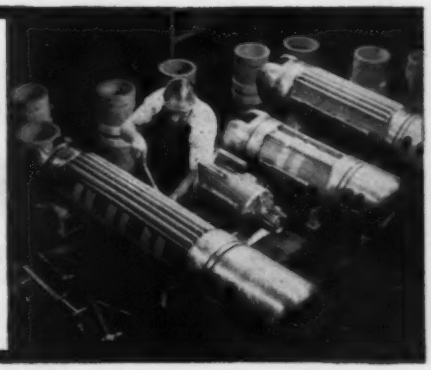
YOU CAN BE **SURE**...IF IT'S

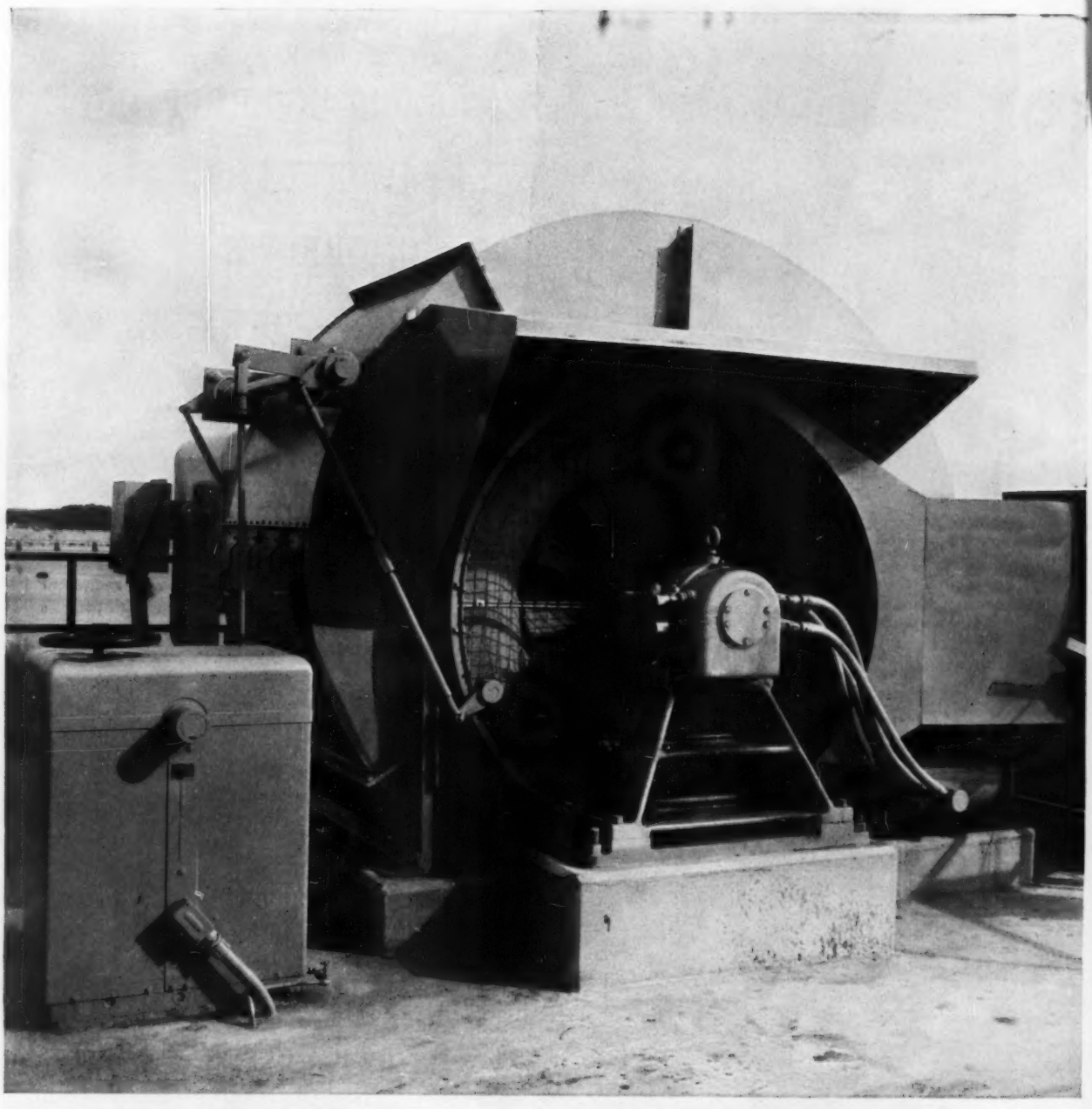
Westinghouse


TRIP COIL ENERGIZED
330 KV 25,000,000 KVA INTERRUPTER
LIFT ROD TRAVEL
3.00 ~ INT. TIME
TEST VOLTAGE 22 KV ACROSS CONTACTS
40,000 AMPERES INTERRUPTED CURRENT

Oscillogram at left is typical of the outstanding performance of Westinghouse circuit breakers in quickly and safely interrupting heavy faults.

One-, two-, three- and four-break grids, at right, provide the maximum interrupting capacities on systems from 69 to 345 kv . . . interrupt faults up to 25,000,000 kva. Interrupter blocks are easily removed for inspection of stationary fingers and moving contacts. Contacts removable without loss of alignment between moving and stationary contacts.





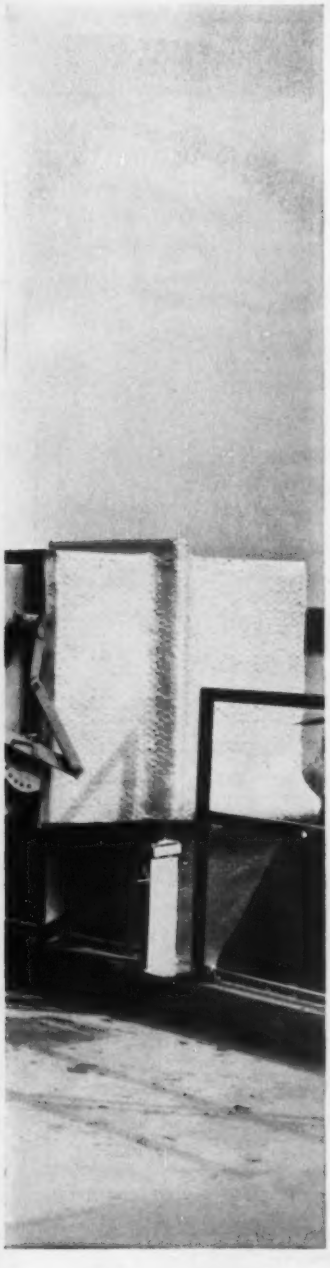
A Typical "Buffalo" Outdoor Forced Draft Installation.

"Buffalo" Mechanical Draft Fans are available with Forward Curved, Radial, Backward Curved and Airfoil Bladed Wheels.

BUFFALO FORGE COMPANY,

Buffalo Pumps Division
Canadian Blower & Forge

VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT



HERE'S MECHANICAL DRAFT PERFORMANCE OUT IN THE OPEN

Here is a typical "Buffalo" Forced Draft Fan engineered for outdoor service. Features "A" apply primarily to outdoor installations. Features "B" apply to Buffalo Forced Draft Fans in general.

FEATURES "A": Note first the air cooled bearing mounted on rigid cast iron pedestals and soleplates. Pressure from fan discharge provides air for cooling. Air passes through automotive type filter before entering oversize cooling passages and specially designed bearing sleeves. Use of air cooled bearings removes danger of freezing.

SHIELD OVER INLET helps keep rain and snow from fan air stream. SCREEN keeps loose objects from entering.

RECIRCULATING AIR DUCT brings preheated air to fan inlet for mixing with outside air to prevent corrosion in air heater at low boiler loads.

PROPORTIONING DAMPERS in this duct regulate and mix the air flow.

FEATURES "B": HEAVY DUTY VARIABLE INLET VANES deeply positioned in inlet for maximum horsepower reduction at reduced loads. Vanes are cantilevered, nothing obstructs inlet air flow. One lever accurately controls dampered combustion.

INSPECTION DOOR has quick opening latches for easy access to fan housing.

OVERALL "Q" FACTOR CONSTRUCTION is strictly heavy duty. Steel plate and rigid bracing contribute to maintenance-free fan life.

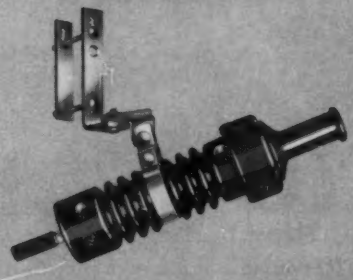
BUFFALO, NEW YORK
Buffalo, N. Y.
Co., Ltd., Kitchener, Ont.

"Buffalo"

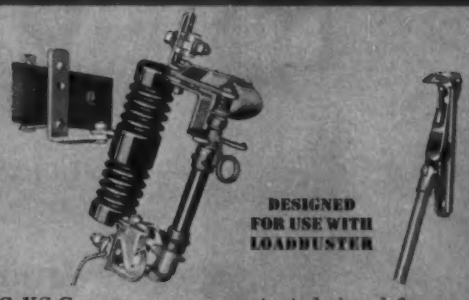
EXHAUSTING • FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING

For every distribution system

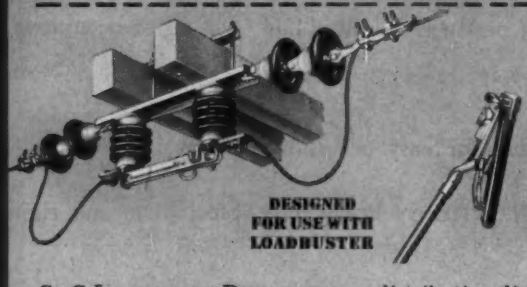
Four devices for low cost load switching at today's higher voltages and loads



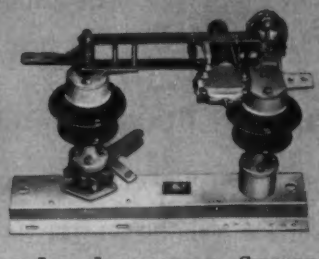
S&C POSITECT—enclosed cutout for full load switching, up to 200 amperes at 5 kv (or as a disconnect—unfused—to 300 amperes). Continuous rating: 50 and 100 amperes as cutout, 100 and 300 as disconnect. Note interrupter attachment at left.



S&C XS CUTOUT—an open cutout designed for use with LOADBUSTER®. Rated 100 amperes continuous as a cutout or 200 amperes continuous with disconnect blade. With LOADBUSTER it will switch full load, and associated charging and magnetizing currents.



S&C LOADBUSTER DISCONNECT—a distribution disconnect, with full published ratings and station-type performance. Rated 15 kv, 400 amperes continuous, 20,000 amperes momentary—95 kv or 110 kv BIL. With LOADBUSTER it can switch all loads, and associated charging and magnetizing currents.



S&C ALDUTI LOAD INTERRUPTER—SIDEBREAK STYLE—three-pole load switching device of long recognized capability. Used primarily for key sectionalizing points. Will interrupt all loads through 600 amperes. Made in 7.2 and 14.4 kv ratings.

S&C ELECTRIC COMPANY

Load switching is a real concern in modern distribution systems, with line voltages of up to 14 kv and load currents as high as 600 amperes. At these voltages and loads, it is impossible or extremely hazardous to open main or branch feeders with ordinary disconnects and cutouts.

Dropping all loads at the source, simply to open a single branch feeder, results in intolerable service interruptions. One alternative—switching with link-break cutouts—is an undependable makeshift. Another alternative—group operated disconnects—still doesn't bring full positive load switching, and is costly.

The S&C solution is a complete "stable" of distribution cutouts, disconnects, and load interrupters—all capable of providing full load switching, at prices to match distribution system economics.

The POSITECT Enclosed Cutout has its own load interrupter attachment. Two other devices—the XS Open Cutout and the Tool Operated Disconnect—are designed to take S&C's portable loadbreak tool, LOADBUSTER®. Finally, the S&C ALDUTI Load Interrupter has a built-in interrupting unit. This reliable interrupter switch has been the standard of the industry for many years.

For additional information on how to give your distribution system universal load switching capability, write to S&C.

S&C Electric Company
4421 Ravenswood Ave.,
Chicago 40, Ill.

In Canada: S&C Electric Canada, Ltd.
8 Vansco Road,
Toronto 14, Ontario

Disconnects • Cutouts • Fuse Links • LOADBUSTER • Power Fuses • Interrupters • Metalclad Switchgear

Specialists in High-Voltage Circuit Interruption Since 1910

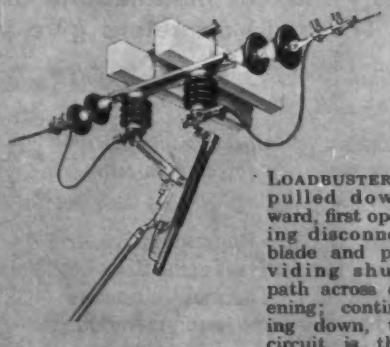
LOADBUSTER®...

S&C's portable loadbreak tool

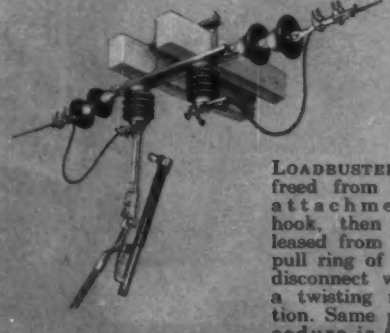
This new portable loadbreak tool is used at the end of a universal hook stick for opening disconnects and cutouts designed for use with it. On today's heavy loads, to 400 amperes, and up to 15 kv, this device gives arc-free load switching.

S&C manufactures two distribution devices mated to LOADBUSTER, the Tool Operated Disconnect and the XS Open Cutout. The sequence below illustrates LOADBUSTER opening the S&C Tool Operated Disconnect.

LOADBUSTER is hooked to attachment hook and pull ring of the Tool Operated Disconnect, preparatory to opening.



LOADBUSTER is pulled downward, first opening disconnect blade and providing shunt path across opening; continuing down, the circuit is then interrupted in LOADBUSTER, which latches open.



LOADBUSTER is freed from the attachment hook, then released from the pull ring of the disconnect with a twisting motion. Same procedure is followed for cutouts mated to LOADBUSTER.

keep an eye on

SYSTEM VOLTAGE

SANGAMO LINCOLN THERMAL VOLTMETERS

are the key to economical system planning

Utility engineers need reliable information on system voltage to solve present distribution problems—maintain specific voltage levels—anticipate tomorrow's voltage requirements.

Sangamo Lincoln Thermal Voltmeters are the lowest cost means of obtaining accurate, continuous knowledge of the voltage spread at check points throughout your system.

Permanent Installations of Sangamo Lincoln Thermal Voltmeters give you these benefits:

- *Continuous record of voltage conditions*
- *Indication of only "steady state" voltage variations for ease in setting voltage regulators*
- *Economical socket installation*
- *Simple reading—quick resetting*
- *Reduction of expensive service calls*
- *Elimination of costly periodic surveys*

Ask your Sangamo Representative, or write us for full information on Sangamo Lincoln Thermal Voltmeters and other Sangamo equipment for system betterment.

BILL OF MATERIAL

1—V2S* Thermal Voltmeter. $30.74

1—Standard Meter Socket . . . 2.92

*Used where outages are not a problem.

1—V3S† Thermal Voltmeter. $42.34

†Minimum reading not affected by outages.

SM58-4

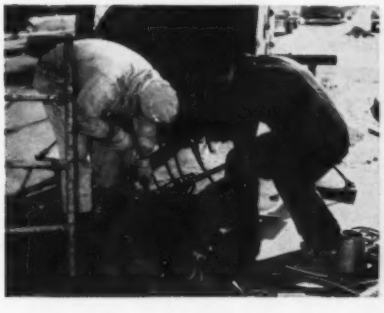
SANGAMO ELECTRIC COMPANY *Springfield, Ill.*

Power Boost with **PARANITE®**

Consolidated Edison is meeting the challenge of mounting demands for electrical power with a systematic program of replacement and expansion. Selected to help carry this ever-increasing load in the Metropolitan New York area is Paranite "Network Power Cable" . . . one of the many Paranite products which backs up a reputation . . . "IF IT'S PARANITE IT'S RIGHT®"

Why PARANITE "NETWORK CABLE?"

Paranite Network Cables are engineered, manufactured, tested and have been proven in installation to meet the severe demands of seasonal peak loads. The consistent performance of Paranite marks it as a product of close quality control!



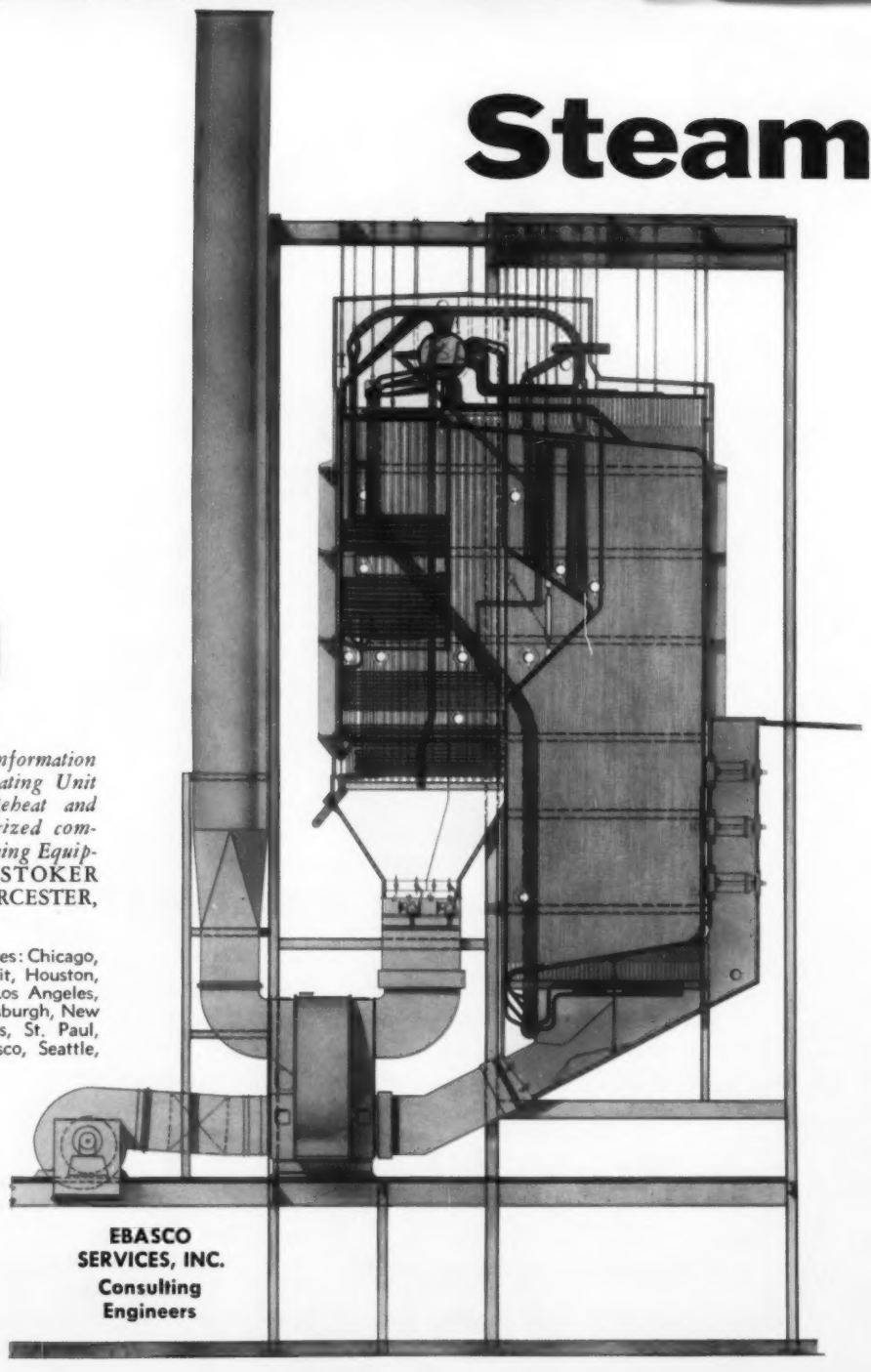
PARANITE WIRE AND CABLE DIVISION

Essex Wire Corporation, Fort Wayne 6, Indiana

MANUFACTURING PLANTS: Birmingham, Ala.; Anaheim, Calif.; Jonesboro, Ind.; Marion, Ind.; Tiffin, Ohio

Sales Offices in all Principal Cities

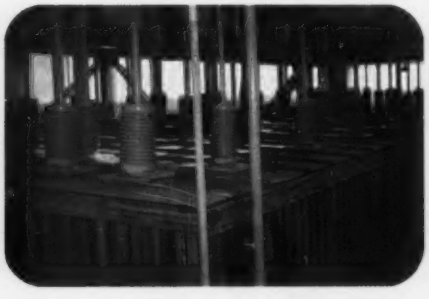
Steam



For more details and information about Riley Steam Generating Unit Designs: Reheat, Non-Reheat and Pressurized, Non-Pressurized complete with Riley Fuel Burning Equipment write: RILEY STOKER CORPORATION, WORCESTER, MASSACHUSETTS.

Offices in these principal cities: Chicago, Cincinnati, Cleveland, Detroit, Houston, Jacksonville, Kansas City, Los Angeles, New York, Philadelphia, Pittsburgh, New Orleans, Portland, St. Louis, St. Paul, Salt Lake City, San Francisco, Seattle, Syracuse.

EBASCO SERVICES, INC.
Consulting Engineers



Contributing to the neat overall appearance is the use of Robertson Lagging over the casing buckstays, an innovation which permits the enclosure of all small piping and attachments between the casing and lagging.

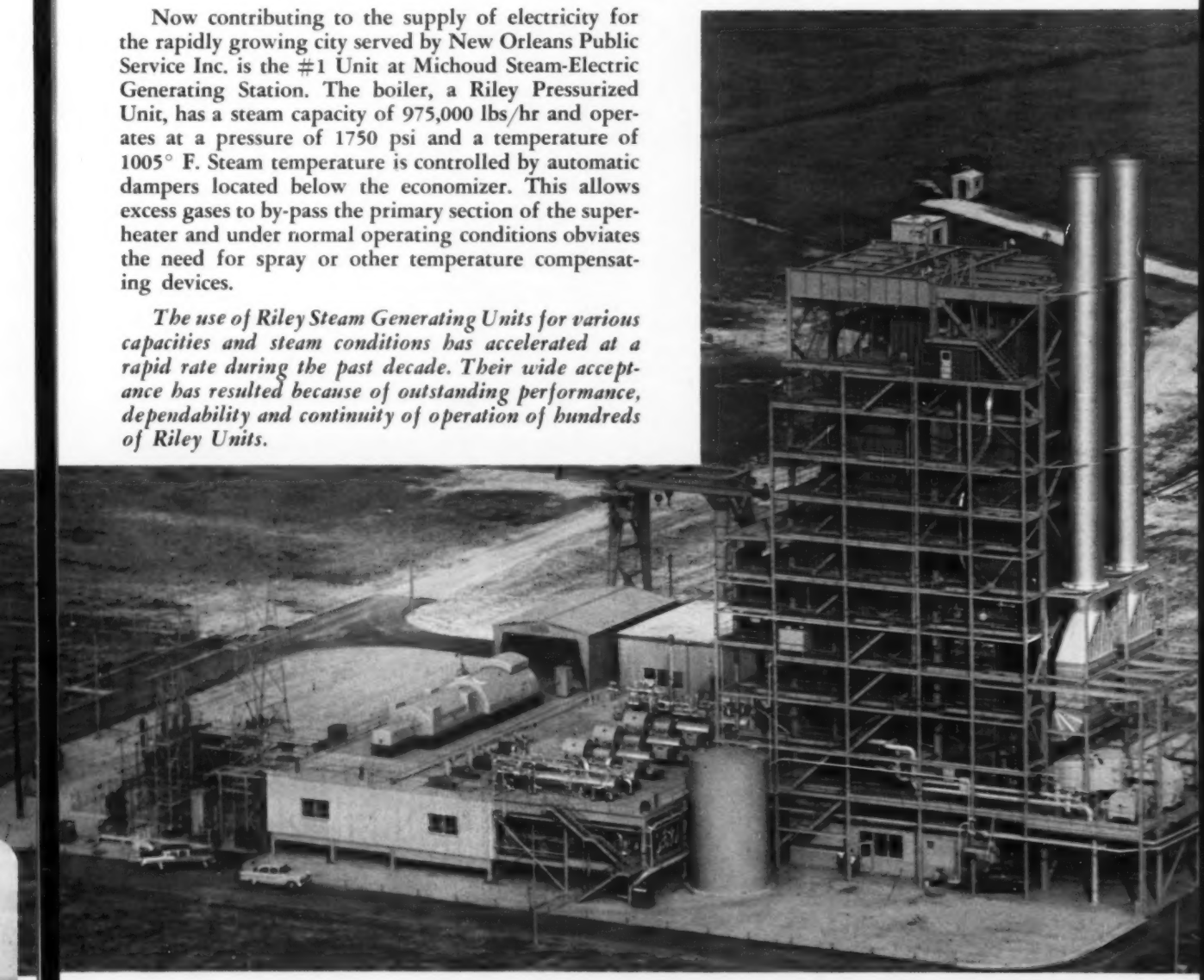
By RILEY

Helps Power New Orleans

Steam for the New 120,000 Kw Unit at Michoud Steam-Electric Station of New Orleans Public Service Inc. is Supplied by a 975,000 lb/hr Riley Boiler.

Now contributing to the supply of electricity for the rapidly growing city served by New Orleans Public Service Inc. is the #1 Unit at Michoud Steam-Electric Generating Station. The boiler, a Riley Pressurized Unit, has a steam capacity of 975,000 lbs/hr and operates at a pressure of 1750 psi and a temperature of 1005° F. Steam temperature is controlled by automatic dampers located below the economizer. This allows excess gases to by-pass the primary section of the superheater and under normal operating conditions obviates the need for spray or other temperature compensating devices.

The use of Riley Steam Generating Units for various capacities and steam conditions has accelerated at a rapid rate during the past decade. Their wide acceptance has resulted because of outstanding performance, dependability and continuity of operation of hundreds of Riley Units.



A survey of your plant by a qualified consulting engineer could show ways of making surprising savings in your power costs.

RILEY

STEAM GENERATING & FUEL BURNING EQUIPMENT

POWER LINE TAKES A SHORTCUT THROUGH THE WOODS ON ITS WAY TO SCHOOL

In Pittsford, N. Y., Rome's preassembled aerial cable took the shortest route through a densely wooded tract of land to provide power for a new school.

Rochester Gas & Electric had the problem of supporting the cable against possible storm damage in the heavy thicket. Here's why they chose Rome's 5-kv preassembled aerial cable for the job:

1. Falling branches—or even trees—can be supported by the cable itself, says Line Maintenance Supervisor James E. Cooper.
2. Tree trimming probably won't be required for another five years, in contrast to the normal two-year period for open-wire systems, according to Carl Foster, Foreman of Monroe Tree Surgeons.
3. Preassembled aerial cable can be installed much faster than its open-wire counterpart, says Bob Tanner, Foreman of R. E. Tanner Line Construction Co.

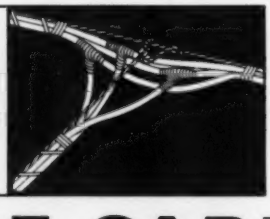
You get these added advantages

Improved regulation. Aerial cable has a lower reactance than open-wire systems—so voltage drop is approximately half as great. Similarly, for a given allowable voltage drop, power can be transmitted twice as far.

Mid-span tapping. The reverse-lay construction of Rome's preassembled cable eliminates the necessity of making taps only at the pole ends of the installation.

Improved appearance. No additional crossarms are needed with Rome's preassembled cable . . . the installation is simple, uncluttered, modern in appearance.

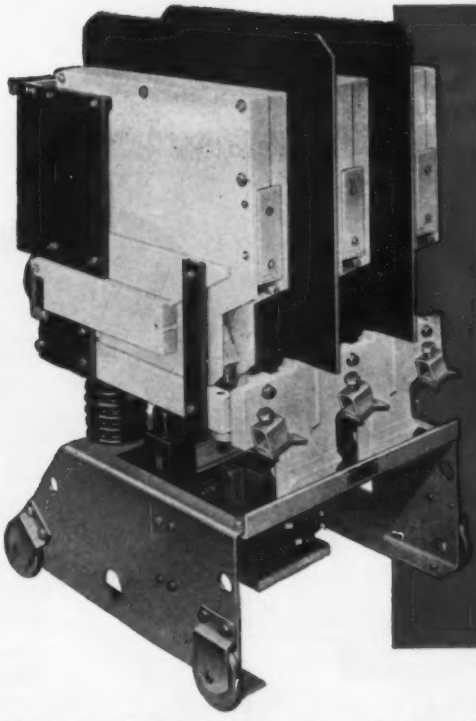
For more facts on this cable that can help *you* shortcut installation, operating, and maintenance costs, contact your nearest Rome Cable representative or write to Dept. 771-B, Rome Cable Corporation, Rome, New York.



In urban areas, long spans like this one might make mid-span tapping necessary. The reverse-lay construction of Rome's preassembled aerial cable permits tapping anywhere along the line (see diagram, at right).

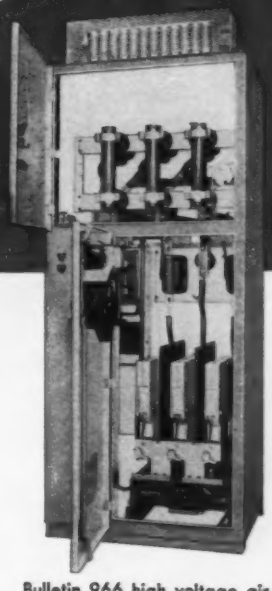
ROME CABLE

CORPORATION



Air break starters
for high voltage motors

A-B QUALITY



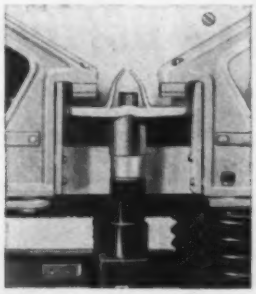
Bulletin 966 high voltage air break, across-the-line synchronous motor starter in NEMA Type 1 enclosure.

This *new* air break contactor—around which Allen-Bradley has developed a complete line of high voltage starters—is designed to match your *toughest* applications. It features the same solenoid design—with only *one* moving part—that has made Allen-Bradley low voltage starters universally recognized for their tremendous operating life.

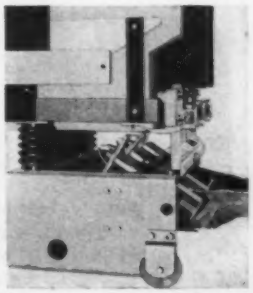
These new contactors are available in full voltage and reduced voltage starters —nonreversing or reversing—for squirrel cage, part winding, slip ring, and synchronous motors up to 1500 hp, 2300 volts; 2500 hp, 4600 volts. All starters are equipped with current limiting fuses and have an interrupting capacity of 150,000 kva at 2300 volts and 250,000 kva at 4600 volts.

It will pay you to investigate these *quality* starters. Complete information is contained in Publication 6080 . . . please send for your copy, today.

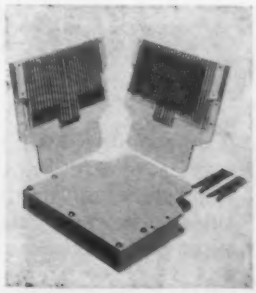
Only One Moving Part. Simple solenoid design eliminates trouble-causing pins, pivots, and flexible jumpers.



Double Break Contacts of silver alloy never need maintenance. Vertical motion assures uniform contact pressures.



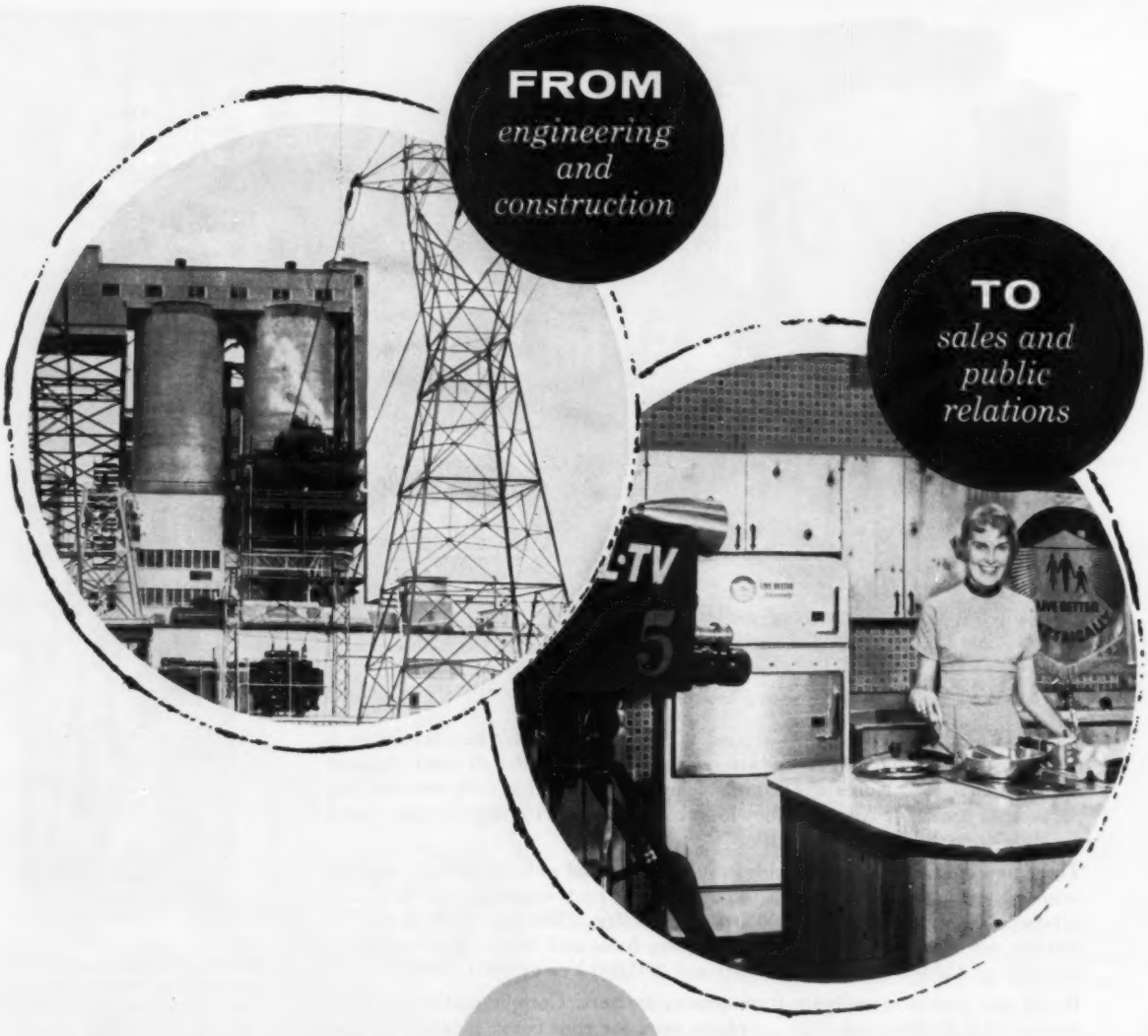
Easy Access from Front. Crossbar and contacts removable from front, without special tools, for easy inspection.



Faster Arc Suppression. New blowout design and novel arc chute. Chutes are molded from an arc resistant material.

Allen-Bradley Co.
1327 S. First St.
Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd.
Galt, Ontario

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY



you can count on quality performance

EBASCO offers many consulting services to utilities. All carry the same stamp of quality that identifies the power plants Ebasco designs and builds.

Take Ebasco's sales and public relations service, for example. It's continually helping solve problems for utilities all over the country. As a client, it offers you a constant flow of up-to-the-minute guidance and information, providing a sound basis for your day-by-day sales and public relations operations.

Or when special sales and public relations problems arise, the broad experience acquired by Ebasco's consultants is solid assurance of a practical solution.

For more information about these services, write: Ebasco Services Incorporated, *Sales, Marketing and Public Relations Consulting Dept.*, Two Rector Street, New York 6, New York.

Challenging career opportunities now available for qualified engineers. For further information, write to our Personnel Director.

Other Ebasco services for utilities include: FINANCIAL AND BUSINESS STUDIES • INDUSTRIAL RELATIONS • INSURANCE, PENSIONS AND SAFETY • PURCHASING, INSPECTION AND EXPEDITING RATES AND PRICING • RESEARCH • SPACE PLANNING • SYSTEMS, METHODS AND BUDGETS TAX • VALUATION AND APPRAISAL • WASHINGTON OFFICE

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OPERATION upturn — Buy now for extra values — GENERAL ELECTRIC

COMPUTER PROGRESS

Digital and Analog Computers at Work

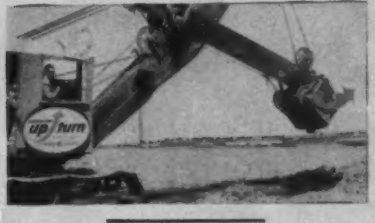
ARTICLE 4 VOLUME 1

COMPUTER DEPARTMENT LAUNCHES OPERATION UPTURN WITH NEW MILLION-DOLLAR PLANT IN PHOENIX, ARIZONA

General Manager H. R. Oldfield, Jr., is pictured at the controls of the Operation Upturn steam shovel which recently broke ground for the new 104,000 square foot permanent plant which is expected to be completed by December of 1958.

"Our business is good and getting better," Oldfield said. "We're going to continue to expand during the year, adding perhaps a hundred or more people." The department now has over 800 employees.

The 160 acre site is located in Deer Valley Park, northwest of Phoenix along the west side of the Black Canyon Highway and south of the intersection with Thunderbird Road.



COMPUTING SERVICES GROUP HANDLES COMPLEX ORIGIN-DESTINATION STUDY FOR WESTERN CITY

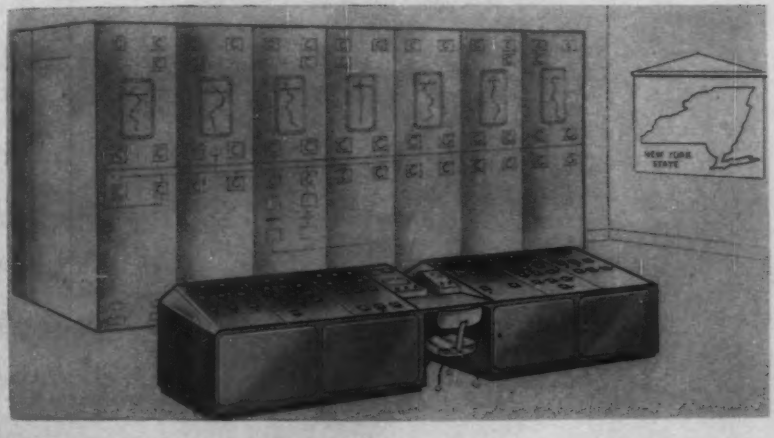
The Computing Services Center of the G-E Computer Department recently completed an origin-destination tabulation for the Phoenix-Maricopa County Traffic Study Group in Phoenix, Arizona. The results of this tabulation, when analyzed, will enable the group to plan the street and highway development program of this desert metropolis for years to come.

The original survey information was obtained by the city-county personnel using the interviewing procedures set up by the U. S. Bureau of Public Roads. The data was put on punched cards and then turned over to G-E for processing and tabulation.

Using manual, or simple computing methods, such tabulations often take many months—sometimes years—to complete. However, using General Electric's giant computer on a rental basis, the job was completed in just a few weeks. The Computer Department also performed the difficult programming job.

(Programming, simply stated, is the translation of the solution method into the language a computer can understand, and the issuance of instructions to the computer so that it will process the information it is fed.)

NEW ECONOMIC DISPATCH COMPUTER SCHEDULES POWER INTERCHANGE BETWEEN FOUR AREAS FOR EASTERN UTILITIES



This new transistorized Economic Dispatch Computer, developed by G-E's Computer Department for the Niagara-Mohawk Power Corp. and the New York State Electric & Gas Corp., represents a significant advancement in the field of dispatch computers.

The computer simulates the equivalent of four power systems as separate operating areas, whereas all previous computers represented either a single system or a group of utilities as a single system. Since it includes Niagara-Mohawk's three operating areas and N.Y.S.E. & G., it represents a large part of the power system of upper New York State. It also incorporates equivalent representation of certain neighboring utility systems.

This special purpose analog computer will produce solutions in a matter of seconds for operating problems which in some cases would take hours or days of manual calculation. It considers individual generating unit efficiencies, fuel costs and transmission losses to assure minimum use of fuel. It automatically computes the optimum schedules of power flow between the four operating areas and the corresponding power flow in the individual interconnecting transmission lines between areas. The computed generating plant outputs and power flows are used by the system dispatcher to schedule system operation. This computer will also be used to determine cost and value of power transactions where large amounts of power are transmitted from one system to another and facilities of a third system may be involved.

Today's rapidly increasing demands for electrical energy have increased the need for this type of complex inter-area scheduling. The problems of operating multi-area systems where transmission line losses are involved have become so complex that a system operator must have a modern computer to accomplish his task adequately.

Although the understanding of how to achieve economic dispatch for such a system has been known for several years, the technique to make the theory practical has only recently been established. Basic theory for the system was developed by Dr. L. K. Kirchmayer and associates of General Electric's Analytical Engineering Section.

The Computing Services Center of G-E's Computer Department is staffed with 125 analysts, programmers, coders —all leaders in the computer field. Their services are available, along with time on the large and versatile type 704 computer, to handle the problems of industry, business, government and education.

For more information contact your nearest Apparatus Sales Office, or Computer Department—Room 224, General Electric Company, 1103 North Central Avenue, Phoenix, Arizona.

CPA—8

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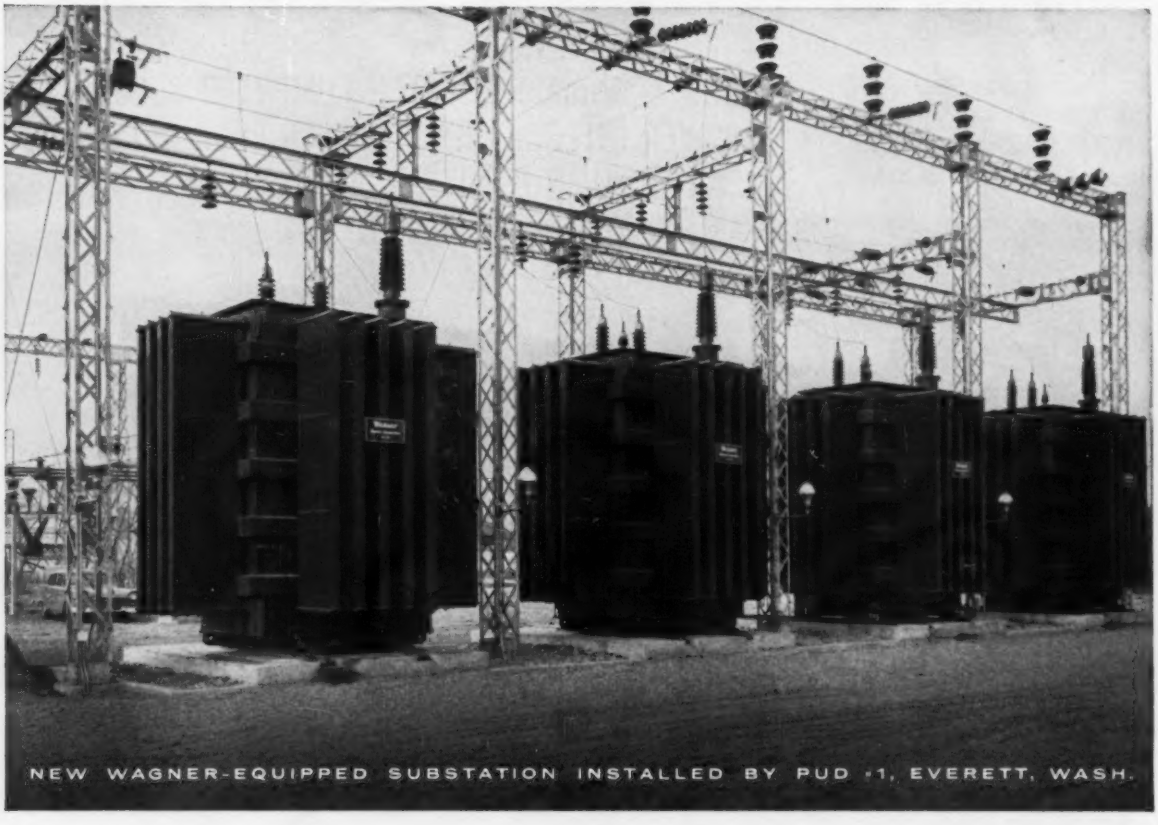
GENERAL ELECTRIC

MORE WAGNER TRANSFORMERS

add system capacity for Snohomish County



NEW WAGNER-EQUIPPED SUBSTATION INSTALLED BY PUD #1, EVERETT, WASH.

With system demand growing at the rate of 9% annually, Snohomish County PUD is adding capacity with more and more transmission and distribution substations.

This recently completed substation is equipped with four Wagner single-phase power transformers rated 10,000/13,333/16,667 kva, 110,000 GrdY to 55,000 Delta Volts.

Wagner builds standard and special power transformers to meet practically all kva and voltage requirements. Consult Wagner about your next power transformer installation. 32 branch offices are at your service. Wagner Bulletins TU-181 and TU-16D tell the whole story. Write for your copies today.

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WT58-14

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The Air Preheater Corp. is constantly working to improve Ljungstrom heating surfaces, seals, bearings, and other structural details. And, in general, these improvements can be applied to existing units with only minor changes and at nominal cost. Another reason why seven out of ten air preheating installations are Ljungstrom. For the full story on how the Ljungstrom design and construction can cut your fuel costs, increase plant efficiency, write for our 38-page manual.

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Field experience proves performance advantages of Preformed splices
In hundreds of thousands of applications, only one failure of a Preformed splice has been reported—and that was caused by inadequate preparation of a heavily corroded conductor.
This distinctive performance is the result of soundly engineered features: (1) uniform radial pressure of the splice rods; (2) full area of contact; (3) the flexibility of the rods which causes the grit particles to penetrate existing oxides and establish permanent electrical contact with the conductor; and (4) the inherent resiliency of the splice which maintains consistent surface contact with the conductor throughout extremes of line tension and temperature variation. These combined characteristics are your assurance of unfaltering mechanical and electrical performance at all times.
And, most important, no tools are needed to install a Preformed splice; the application is made entirely by hand and takes but a fraction of the time required for other types of splices.
There are Preformed splices to solve almost every splicing problem. They can be furnished to hold the full-rated strength of any standard transmission or distribution conductor.
Write for additional technical information. PREFORMED LINE PRODUCTS COMPANY, 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable Address: Preformed-Cleveland . . . manufacturer of armor rods, dead-ends, Guy-Grip dead-ends and other line accessories.
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10 YEARS OF Power Line Progress
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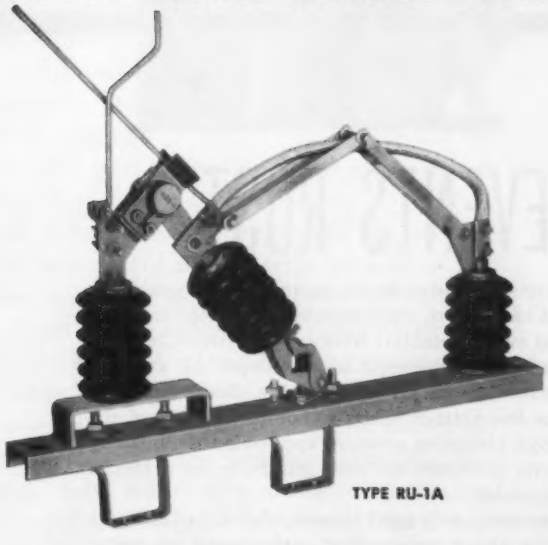
Made in accordance with or for use under U.S. Patent Nos. 2,609,653; 2,275,019; 2,587,521; and 2,691,685. Other patents pending.

For low-cost switching choose a Southern States tilting insulator disconnect

TYPE TR-1A



TYPE RU-1A

TWO COMPLETE LINES

When easy, low-cost installation is the first requirement for disconnecting switches, Southern States offers you not one —but two complete lines from which to choose.

The Type TR-1A is a high-quality rocker-type disconnect that meets NEMA Standards in every respect. It is available in voltage ratings from 7.5 kv through 69 kv and continuous current ratings of 200, 400, and 600 amps.

The Type RU-1A is a distribution level tilting insulator switch specifically designed for pole-top mounting. Its dielectric strength is the same as standard levels for other distribution equipment, but it is below NEMA Standards for power switching equipment. It is available in voltage ratings of 7.5 and 15 kv and continuous current ratings of 200 and 400 amps.

Both types are ruggedly constructed, and will provide reliable switching under all service conditions. Many utilities throughout the nation have found in these switches the answer to their needs for low-cost, easily installed disconnecting switches. So can you. Get full details in our Bulletins 54 RU and 3050.

EASY INSTALLATION

One reason utilities find the installation of these switches so easy is the method for affixing the interphase shaft to the rocking insulator. The shaft is laid in its proper position across all three phases and then only one bolt per phase is tightened to complete the installation, saving valuable installation time in the field.

SOUTHERN STATES
EQUIPMENT CORP.
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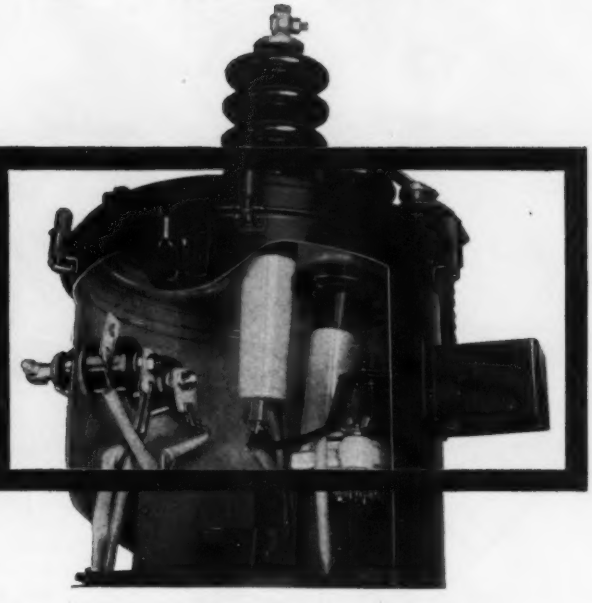
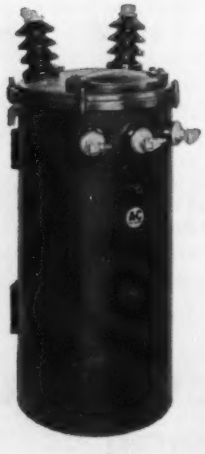
There's a good reason WHY...

Distribution transformer bushings should be

CLAMPED FROM THE INSIDE



smooth surface PREVENTS RUST



SHARP corners of external hardware are especially vulnerable to rust. And once rust has a start, your maintenance problems multiply fast. To eliminate every potential trouble spot, Allis-Chalmers devised *internal* clamping arrangements for bushings. All external hardware has been eliminated without changing the effective method of gasketing. Two-piece low voltage bushings compress and seal the tank wall gaskets through clamping pressure applied by the bushing studs. High voltage cover bushings are held internally by a keeper plate and spring arrangement.

This is just one of the many very good reasons why Allis-Chalmers distribution transformers assure outstanding performance for many years. For all the "good reasons," call your A-C man, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

A-5718

Recovery and Your Budget

In drawing up utility budgets for 1959, policy makers should consider two additional objectives of particular importance this year. One is to make sure the budgets contribute to the recovery trends now taking shape in the economy. The second is to make sure that the individual utility is prepared to take full advantage of the national "all electric" promotion program to be operated by EEI next year.

While electric utility revenues have held up relatively well, sales growth has suffered substantially from the 10-month recession. Recently there have appeared some pretty firm indications that the economy is beginning to turn up. Appliance shipments for June and July show substantial gains over early months and some major residential items are well above the same months last year. Power output figures for the past three weeks have swung out of the minus columns to reach a record peak.

To bolster these hopeful signs, the utilities must take a hard look at their sales plans and sales programs for the next year. They must share with other industry the responsibility for accelerating recovery trends by increasing sales.

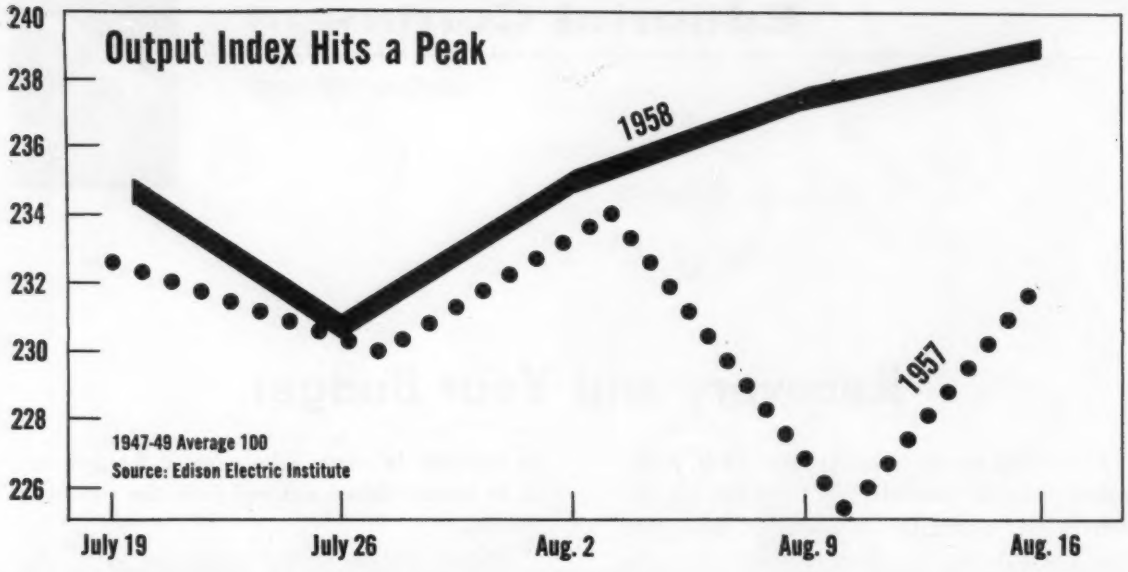
For many utilities this means greatly expanded sales efforts, broader sales programs, additional manpower, and more intensive promotion programs. Sales figures now available for the first five months of the year indicate that hard work is required in every sales area if the industry is to recover losses suffered from the recent recession.

Budget makers should reappraise sales allocations which amounted to a mere 1.6% of gross revenues last year, and carefully consider the potential returns from expanded sales efforts. Utilities last year spent just 30¢ to bring in one dollar of new revenue. That is less than a third of the cost of bringing in a dollar of new revenue in the pre-World War II days.

Very much in this sales budget picture for next year is the national "all electric" promotion program which utilities are committed to support. In our opinion, it would be a grievous mistake if utility budget makers decide to trim local sales programs to provide funds for the national promotion program.

Such a national program can only be effective if backed by intensive local promotion and sales efforts. If it is to be fully exploited, utilities must provide the forces needed to convert its potential into kwhr sales.

Whether the utility industry is able to make its fair contribution to the recovery trends and whether it will be able to reap the full rewards of its national promotion efforts depends to a great extent on the neat rows of figures that are now beginning to appear on utility budget sheets.



Despite lagging industrial sales . . .

Brief Hot Spell Hikes Output Figures

For the week ending Aug. 16 both the electric output index (above) and the actual output figure (see page 19) set a new high for the U. S. electric utility industry. The gains came mainly because of air conditioning loads and not because of any appreciable pick-up in industrial sales, according to a random sampling of utilities.

The output index, which is seasonally adjusted, reached 238.9 for the period ending Aug. 16. Actual output totaled 12,851 million kwhr, based on reports received by Edison Electric Institute. Both figures surpass the highs of last winter. The statistics include information gained from power companies, cooperatives, and government-owned utilities.

The new index and output records probably will hold until winter, if past summer peaking characteristics hold true to form. The high spots aren't providing too much to crow about, however. Lagging industrial sales and a relatively cool summer's drag on air conditioning loads have combined to hold power sales below expectations for some utilities.

One bright spot, though, is the generally good water conditions which have enabled power producers in several regions to profit from base loading hydro plants.

Georgia Power Co, for instance, has hydro generation 16% above last year. Its storage lakes are close to full. Heavy rains have made stream flow slightly above normal in Duke Power Co's area where, of an anticipated total 12-billion kwhr production in 1958, Duke expects to produce 11 or 12% with hydro.

New Record at Elephant Butte

Water storage at Elephant Butte Lake—Public Service Co of New Mexico's only hydro source—is the highest in ten years, now topping a million acre ft or about half of total capacity.

The Tennessee Valley Authority reports water storage is at all-time highs also. There's enough to generate more than 5-million kwhr at hydro plants, it said. The high storage permitted a build-up in coal stockpiles to 6.8-million tons as of June 30, TVA said.

The U. S. Bureau of Reclamation has reported above normal water storage in most of its 150 reservoirs in the 17 western states. The large volume of storage caught in reservoirs last winter and spring—after years of drouth—has helped offset below normal precipitation in some areas this summer.

Water outlook is termed "good to excellent" by the bureau in the Pacific Northwest and California. A dry spell from eastern Idaho through parts of Utah and Colorado has caused irrigators to rely heavily on storage to carry their crops through.

Reduced precipitation and runoff in the Southwest has been offset by availability of more water in bureau reservoirs than at any time in the past decade, the agency said.

The Weather Bureau in Washington calls the summer an exceptionally wet one in most areas. Heavy rains have fallen from the mid-Great Plains area eastward to the mid-Atlantic coastal region and southward to the Mississippi River Valley.

From Virginia north through New England, precipitation has been well above normal. Southern New Jersey, for instance, had 19.3 in. of rain in the first seven months of 1958. This is three and a half times greater than the same period last year.

Rainfall was also well above normal from western Kansas east

across Missouri, Illinois, Indiana, and the Ohio Valley into the Atlantic Coast region. The heavy rainfall in these areas has been accompanied usually by cooler temperatures, the Weather Bureau said.

The 30-day outlook released Aug. 15 forecasts temperatures to average below seasonal normals in the Northeast; above normal in the West and South Atlantic states; and about normal temperature for other areas.

Rainfall may exceed normal in the Ohio Valley and in the North and mid-Atlantic states, the forecast said, while subnormal amounts are expected in the Northwest and also in the Southern plains and upper Mississippi Valley.

It's the Heat and Humidity

Commonwealth Edison Co experienced an all-time peak on Aug. 11 when output exceeded 3,900 Mw, on a preliminary estimate basis. The previous record was Aug. 15 of last year at 3,832 Mw. The peak was established despite the fact that industrial use actually was below a year ago, the company said.

Temperature on the day of Commonwealth's peak hit 85 deg and humidity was at 60%. This combination, plus only 53% possible sunshine, sultry breezes of 4.4 mph, and a temperature of 92 deg the previous day, added up to the record-breaking demand.

Much the same circumstances accounted for the high of Consolidated Edison Co of N. Y., except it came a month earlier on July 16. The peak was 3,475 Mw *vs* 3,460 Mw set June 26, 1957. This year's record came when temperatures ranged from 72 to 85.5 and humidity from 56 to 84. About one-fourth of the company's capacity is used for air conditioning, the company estimates.

Cleveland Electric Illuminating Co's summer peak was hit during the week ending Aug. 16 when 130,200,000 kwhr were used. This was 16,600,000 kwhr under its winter peak.

Aug. 15 brought summer highs for utilities in the Dallas, Tex., area. The peaks followed several days of high temperatures and were not attributed to any change in industrial load. Lee Cook, vp of Texas Power & Light Co, said there's a possibility the Aug. 15 peak could be topped slightly before the end of the month.

STREAMFLOW INCREASED when timber above Fool Creek (Colo.) was cut in "chains." Sediment yields have been low. U. S. Forest Service photo.

Tests Hint Water Bonanza

Research in California and Colorado indicates that hydro operators can profit from lending Mother Nature a hand when it comes to boosting streamflow from watersheds. In the test clearing of mature timber shown above, the U. S. Forest Service shows "appreciable increases in streamflow." One half of the timber was removed to increase the water yield from Fool Creek watershed at Fraser Experimental Forest near Fraser, Colo.

The Forest Service report of the test summarizes 12 seasons of stream flow records before the harvesting of timber and one season after completion of timber cutting. The report emphasizes: "The effects are of a preliminary nature only, and are not necessarily indicative of what might be expected over . . . several years."

Issued by the Rocky Mountain Forest and Range Experiment Station at Ft. Collins, the report describes Fool Creek research dating back to 1943. After roads were completed, timber harvesting began in 1954 and was completed two years later. Merchantable timber covered 550 acres of the 714-acre watershed. The area actually cleared amounted to 278 acres.

Timber was cut in strips of one, two, three and six chains (one chain is 66 ft wide). The harvested strips alternate with equal-width uncut strips. Slope length of most strips is 600 ft.

Watershed elevation ranges from 9,600 to 11,500 ft. Slope gradients vary from 10 to 60%, with an average of about 25%.

The report says the streamflow increase "is estimated to be 250 acre ft in 1956 and 200 acre ft in 1957. The spring flood peak was increased the first year after cutting and decreased in comparison with the control in the second year." Interaction between spring weather and treatment may explain the difference in spring peaks, the report says.

Sediment yields since the cutting have been low. Snow accumulation was increased on the cut strips and the increase appears about the same for each of the widths of strip used and tested.

Research by the University of California has shown water flow in springs and streams can be improved dramatically by clearing watersheds. Madera and Lake county tests resulted in spring flows as much as twice what they had been, and in some cases dry springs began to flow.

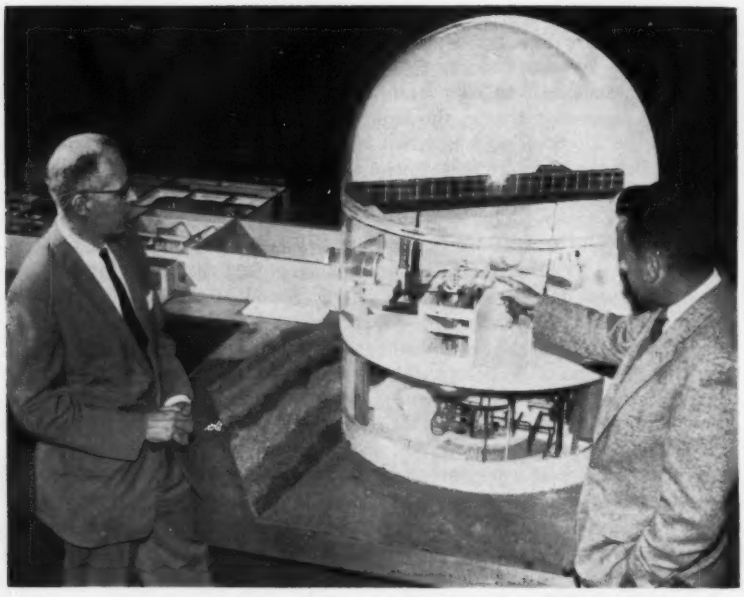
H. H. Biswell and A. M. Schultz of the university's school of forestry conducted the tests.

Fencing Foils Falling Rocks

To protect workers from falling rocks, Pacific Power & Light Co uses 70,000 sq ft of 2-in. mesh, 6 gauge fabric, on its Swift hydro project. The fencing covers walls above the Lewis River in southwestern Washington where the 510-ft earthfill dam will produce power sometime in December.

Fabric is draped over the forebay, which will funnel water from a reservoir to the 25 ft dia, 1,575-ft long power tunnel.

Installation of three 107,000-hp Francis type turbines is well under way at the site. The trio will provide 250 Mw capacity. Turbine installation has recently started at a companion plant, 3½-mi downstream, of Cowlitz County PUD.



Research Unit Brightens Fuel Outlook

Herbert M. Parker, left, manager of Hanford Laboratories for General Electric Co, looks over model of new plutonium recycle reactor under construction at Hanford Works with Robert M. Fryar, manager of reactor engineering for GE at Hanford. Use of plutonium as an enriching agent in power reactors will be investigated in the $15-million unit. GE officials said the plutonium can be used instead of the costlier uranium 235. Also being constructed in conjunction with the test reactor project is a pilot plant to assemble fuel elements. GE is operating contractor at Hanford for the Atomic Energy Commission.

Atomic Progress

• AEC capitalizes on leak

Despite a leak between the reactor core and blanket regions, the Homogeneous Reactor Experiment No. 2 (HRE-2) has operated effectively for prolonged periods up to 5,000 kw. The HRE-2 went critical Dec. 27, 1957, then was shut down in April when the leak developed.

The unit, designed to operate with a heavy water fuel solution of uranyl sulfate circulating in the core, currently produces about 3,000 kw(t) in the core region and 2,000 in the heavy water blanket region. Union Carbide Corp designed, developed, installed and is now operating the HRE-2 for the Atomic Energy Commission.

BRIEFS: Britain's Atomic Energy Authority will not rehabilitate the Windscale pile that emitted a radioactive shower last October.

The contract between Carolinas Virginia Nuclear Power Associates and AEC for a 17,000-kw prototype provides that CVNPA will pay estimated construction costs of $30 million. AEC will handle $14 million R&D and fuel rental.

CRITICAL PHASE of Oahe Dam closure came at 1 A.M. Aug. 3 as turbulent water rushed down 70-ft wide trench

BLUFF-TO-BLUFF barrier went in downstream (foreground) first with help of $10 million worth of equipment

U. S. Power Picture

- **Ticklish closure undertaking achieved at Oahe Dam**
- **Texas judge rules relocation law is constitutional**

A construction milestone and a big boost in Missouri River power output both were achieved Aug. 3 when closure was carried out at Oahe Dam near Pierre, S. D.

The operation at the $380-million project, largest compacted earth dam in the world, was a climactic step toward which workmen have labored ten years. Oahe is a key structure in the Army Engineers' billion-dollar complex of Missouri River dams.

During much of a dam's construction the river is left to flow undisturbed in its course while the dam is built to full size on either bank. Closure comes when the gap is filled and the dam becomes, in actuality, a dam.

Because closure is always a ticklish proposition, Army Engineers made elaborate advance plans to load the odds against the river. Western Contracting Corp had on hand $10-million worth of equipment. The Missouri's outflow at Garrison Dam 325 mi up the river was squeezed from 30,000 to 7,000 cu ft/sec to reduce the amount of water to be fought.

These precautions were canceled in part when nature and the river pitched a curve. About four inches of rain fell in the South Dakota Black Hills and came roaring down the Cheyenne River into the Missouri. The Big Muddy's volume increased to 8,800 cu ft/sec and prospects were that this would peak out at 12,000 cu ft at the time the closure was in its critical phase.

Army Engineers moved up the schedule 12 hours to get closure accomplished before the peak water hit and began a contingency modification of the plan. The operation went smoothly and at 3:35 A.M. on Aug. 3—21 hours and 61,000 cu yd after work began—the gap was blocked.

"Hell," a cat skinner exulted, "we could have closed it with talcum powder."

Thereafter water began building up in a reservoir that eventually will be longer and deeper than Lake Erie and will provide power to turn Oahe's 595-Mw generators. Installed capacity of all six Missouri River dams eventually will be 1,775 Mw; it now is 740 Mw.

Maj Gen Gerald E. Galloway, Missouri River Division chief of Army Engineers, said Oahe will enable the other dams to increase power production from 3 to 3.5-billion kwhr annually, hike capability from a current 540 to 600 Mw, increase the output of firm power by about 10% and hike power revenues by about $1-million a year to a yearly total of some $12 million.

• The multi-million dollar cost of moving utility facilities in the path of interstate highway construction should be paid with federal funds, a Travis County, Tex., district judge ruled Aug. 14.

Judge J. Harris Gardner upheld the constitutionality of a 1957 Texas law declaring that funds of the state-federal interstate road program can be spent for relocating utilities.

The judgment, if upheld, means the state will reimburse cities and utilities for the estimated $100-million expense of moving facilities. Ninety per cent of the cost will be paid from federal funds allocated to Texas for the road program. The state will pay the remaining 10%.

The Attorney General's Department gave notice of appeal, contending the law violates six different provisions of the Texas constitution. In the '57 law, the legislature gave the highway commission broad authority to locate interstate roads and provided that funds could be used to buy R/W and pay for utilities' changes, as well as for construction.

BRIEFS: The 108-mi coal pipeline linking Cleveland Electric Illuminating Co's Eastlake Plant to coal fields of southern Ohio is now in full operation. June shipments totaled 102,000 tons. The pipeline will deliver 1,250,000 tons a year, or about 40% of CEI's present total annual coal requirements and 80% of the consumption at Eastlake.

Higher postal rates will tack on about $8 million a year to U. S. electric utility expenses, according to EW estimates. Some $6 million of this will go for customer billing costs.

International Currents

• Top-level U. S. executives get the red-carpet treatment in Russia before attending Geneva atom meeting

McGraw-Hill World News: Moscow—A ten-man delegation from top U. S. electric utilities and electrical manufacturing companies is now touring the U.S.S.R. under a cultural and scientific exchange program with the Russians.

Upon arrival Aug. 14, the group was briefed at the Ministry of Power Stations on the overall U.S.S.R. power program, then visited a thermal power station in the Moscow suburbs as well as a dispatching center in the city.

Other sites visited include the Cherepetz Power Station about 120 mi south of Moscow and Noginsk Power Station east of the capital.

The U. S. delegation already has seen installations which have been hitherto barred to Americans. Members were given a rare briefing at Gosplan, the state planning body, on how power planning fits in overall Soviet economy. There has been no answer yet to the group's request for a visit to power installations east of the Urals and to Siberian regions.

Members of the group said they are getting "a tremendous amount of information verbally" and have been promised considerable printed material. The visitors, most of whom are accompanied by their wives, will split into three groups in order to increase coverage.

The group, sponsored by Edison Electric Institute and Association of Edison Electric Illuminating Companies, is headed by Walker L. Cisler, Detroit Edison Co president. Other members include:

Harvey Bumgarder, EEI; James F. Davenport, executive vp, Southern California Edison Co; Don S. Kennedy, president, Oklahoma Gas & Electric Co; Elmer L. Lindseth, president, Cleveland Electric Illuminating Co; Gwilym A. Price, board chairman, Westinghouse Electric Corp; Philip D. Reed, chairman, finance committee, General Electric Co; R. G. Rincliffe, president, Philadelphia Electric Co; Joseph L. Singleton, executive vp, Allis-Chalmers Mfg Co; and Edwin Vennard, vice president and managing director, EEI.

Members of the group said power plants they had seen to date indicated "good efficiency" and they commented on extensive use of aluminum piping. They said thermal stations averaged twice as many burners as U. S. plants due to use of lower grade coal.

Among hydro plants which the delegation is planning to visit are the 2,300-Mw Kubiyshev project and Stalingrad facilities. The Russians have agreed that the group can visit a 5,000-kw atomic power plant which is now in operation. Delegates also are hopeful the Soviets will agree to a visit to the first large atomic power plant installation which is now under construction.

The top-level attention accorded the visitors is attributed to the high-ranking make-up of U. S. participants, who will report to the State Dept on their findings when they return. The group also will make a detailed report which will be published by EEI.

The American group's visit is under the auspices of the U. S. State Dept, which said the Russians will be extended a reciprocal visit to America.

Originally the Russian contingent was slated to reach the States in October, but this has been set back until spring. The State Dept has not yet announced what U. S. facilities will be on the itinerary.

Last week, EEI announced that it would sponsor an exhibit and present a paper at the Geneva atoms-for-peace conference Sept. 1-13, which all of the U.S.S.R. visitors are expected to attend. The paper was developed by EEI's Committee on Atomic Power. It describes the nuclear power program of investor-owned companies in the United States.

Representatives of the committee who will attend the 2nd Geneva meeting include Lindseth, Rincliffe, and W. J. Clapp, Florida Power Corp president.

Among other utility presidents planning to sit in on the Geneva sessions are Harllee Branch, Southern Co; Philip Sporn, American Electric Power Co; and Charles Whitmore, Iowa-Illinois Gas & Electric Co.

The Washington Wire

• Utilities to have after-the-fact say in ad tax ruling

Electric utility company contributions for advertisements sponsored by the Electric Company Advertising Program (ECAP) are undergoing more analysis in Washington.

Officials at Internal Revenue Service—where the tax deduction issue seemed already settled—and Federal Power Commission are pondering difficult questions involving federal law and the industry's advertising.

Last February, Internal Revenue Commissioner Russell C. Harrington ruled that company contributions to these ads are not allowable tax deductions.

Now, however, IRS is allowing power company spokesmen to come to Washington and try to change official minds on the issue. IRS will not disclose who it is seeing or how long it will listen to industry spokesmen before making up its mind again.

Whether these after-the-fact consultations with IRS officials will actually result in a switch on the tax issue is doubtful, according to some Washington observers. But utility spokesmen at least have won a last minute chance to present their side of the story. IRS says the question is entirely a factual one—were the ads in question intended to influence legislation or used to lobby?

Back in February, Harrington seemed pretty certain of the facts. He announced his ruling in a letter to Sen Estes Kefauver (D-Tenn.), who has been leading an attack by public power advocates against

ECAP ads. Kefauver says the ads are "political propaganda, pure and simple." At the time, Kefauver hailed Harrington's decision as clear support for his charges.

The IRS ruling was based on a field investigation ordered by Harrington. He told Kefauver the law requires ad expenses must be ordinary and necessary and bear a "reasonable relationship to the business activities in which the enterprise is engaged," in order to be deductible.

After considering the evidence submitted by the field offices, Harrington informed Kefauver, IRS concluded contributions to the ads were not allowable deductions. This is based on IRS regulations, which bar deductions for various types of expenses—including any incurred for "lobbying," for the "promotion or defeat of legislation," for "political purposes," for development or exploitation of propaganda, or to other matters "in the area of political controversy."

Utility companies asked to be heard on the case after the Harrington ruling was announced, IRS officials say. At stake is the industry's argument that advertising to meet competition is a proper business and tax expense—whether it comes from other business enterprises or from the federal government in the form of public power projects.

At the Power Commission, a prehearing conference Sept. 9 probably will show what arguments 76 power companies will use to counter FPC charges. The commission staff says the companies improperly charged $863,130 in contributions to the 1957 ECAP ad program as business expenses, rather than as miscellaneous deductions, after taxes.

To date, no company brief has been filed with the FPC, and only one state utilities commission (Pennsylvania) has written it may wish to testify (the FPC order specified that any state regulatory body could file as an interested party). The hearing is scheduled for Oct. 7.

Involved in the complaint are nine advertisements, which appeared throughout 1957, devoted principally to the private-vs-public power issue of tax favoritism. All companies named in the FPC order, issued Aug. 1, are required to be represented at the October hearing.

World Power Group Aligns U.S. Speakers for 15th Meeting

Representatives of U. S. utility and electrical manufacturing companies will be among more than 1,000 delegates from about 50 countries attending the World Power Conference sectional meeting to be held Sept. 7-11 at Montreal, Canada.

Theme of this 15th session will be "Economic Trends in the Production, Transportation, and Utilization of Fuel and Energy."

First Session Here Since '36

Since the first conference was held in Great Britain in 1924, it has met only once previously in North America—in Washington, D.C., 22 years ago.

The U. S. National Committee has K. M. Irwin, Philadelphia Electric Co, as chairman; Francis L. Adams, Federal Power Commission, vice chairman; and, Brig Gen Stewart E. Reimel, U. S. A. (Ret.), Engineers Joint Council, secretary.

Americans who'll address the session and their topics are:

Fred R. McCormick and Finas C. Harvey, Idaho Power Co, "Water Resource Development on the Hells Canyon Reach of Snake River."

William J. Rheingans, Allis-Chalmers Mfg Co, "New Developments in Design and Construction of Hydraulic Turbines."

A-Power Program Is Topic

James F. Fairman, Consolidated Edison Co of New York, Inc, "Nuclear Power Programs of Public Utilities in the U. S."

George A. Porter and Dick E. Hart, Detroit Edison Co, "Economic Trends in the Generation of Electric Energy in the Detroit Edison System."

E. S. Harrison, Georgia Power Co, and N. F. Williams, Southern Services, Inc, "Economic Trends in the Production, Transportation, and Utilization of Fuel and Energy on a Large Utility System."

Philip Sporn and S. N. Fiala, American Electric Power Service Corp, "Evaluation of Supercritical Pressure Steam Plants Based upon the First-Time Operating Experience at Philo."

J. K. Dillard and Miles Maxwell, Westinghouse Electric Corp, "Economics of Extra-High-Voltage Transmission."

John I. Yellott, Association for Applied Solar Energy, "Solar Energy Utilization in North America."

Charles E. Webber, Sun Oil Co, "The Interrelationship of Oil and Gas Production."

E. G. Nielson and C. C. Anderson, Dept of the Interior, will speak, respectively, on: "Modern Hydroelectric Potential Evaluation" and "Petroleum and Natural Gas in the U. S.—Relation of Economic and Technologic Trends."

Donald H. Stewart, Atomic Energy Commission, will discuss "U. S. Nuclear Power Generation Costs," and Norman C. Nelson, FPC, "Factors Affecting Use of Electric Energy in the Home."

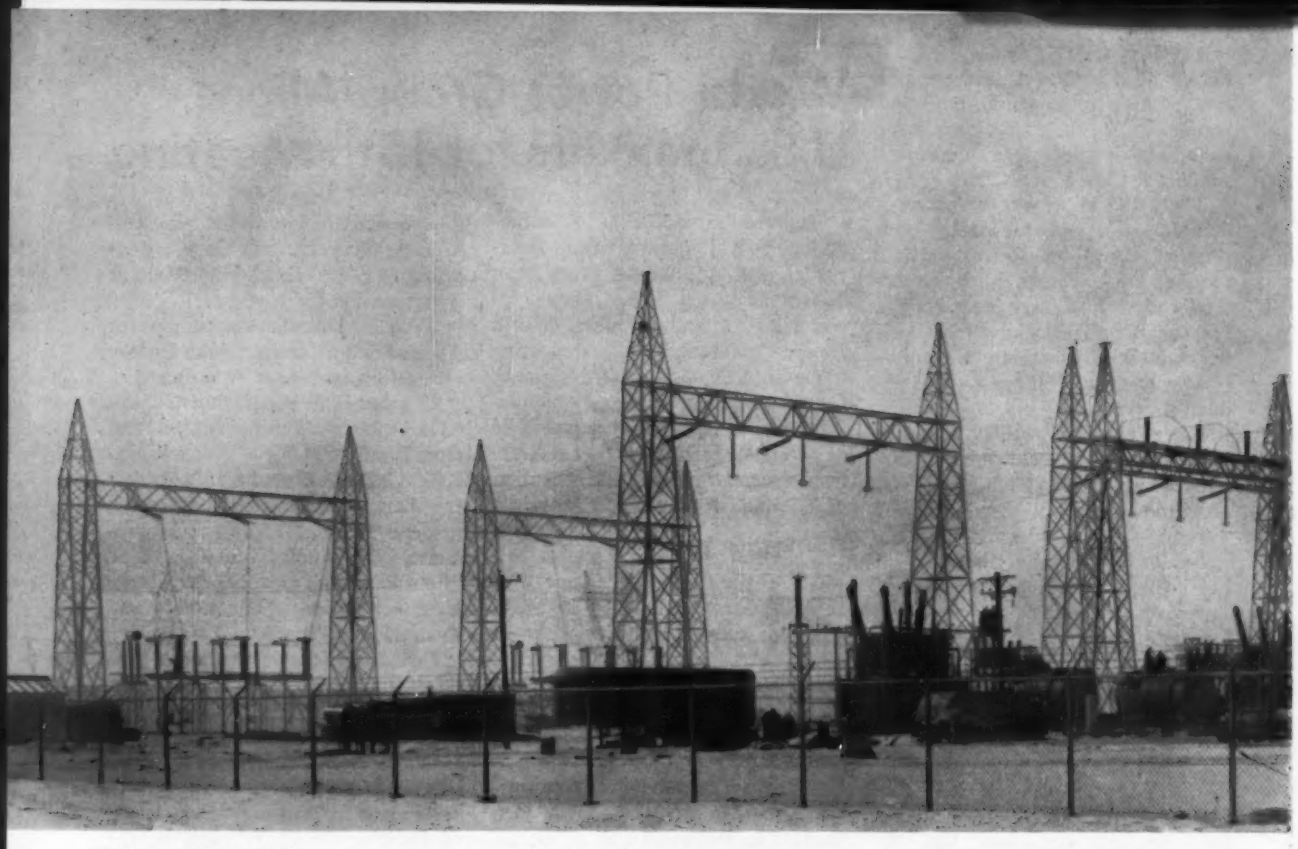
"Trends in Water Transportation of Fuel in the U. S." will be the subject of Brig Gen J. L. Person, Chief of Engineers. J. P. Schaenzer, REA, Agriculture Dept, will talk on "Farming Better Electrically in the U. S."

The meeting will take place at the Queen Elizabeth Hotel. Discussion of the papers will be in English and French, and there will be translating facilities.

Tours Scheduled in U.S., Canada

Post-conference tours will include visits to the St. Lawrence Seaway and Power Project, Shippingport, Pa., for inspection of Duquesne Power Co's A-plant, and to hydro sites at Beauharnois and on Quebec's Saguenay, Peribonka, Bersimis, and St Maurice rivers. Arrangements also may be made for inspection of the Richard L. Hern thermal plant in Toronto and a hydraulic laboratory at Islington, Ontario.

Hugh Crombie, vice president, Dominion Engineering Works, Ltd., is general chairman of the subcommittees making arrangements for the Canadian meeting. General secretary is T. M. Patterson, director of the Water Resources Branch of Canada's Dept of Northern Affairs and National Resources.



345-KV SUBSTATION at Goodings Grove, Ill., 27 miles southwest of Chicago, forms the terminus of the 345-kv tie between Commonwealth Edison and AEP systems. Last winter's stark landscape reveals structures and circuit break-

Goodings Grove Substation Is

Commonwealth Edison's new facility terminates 345-kv tie with American Electric Power; joins 345, 138-kv systems

J. H. SCHROEDER and **H. P. TOSCH**, Electrical Engineers, Commonwealth Edison Co, Chicago, Ill.

Commonwealth Edison Co's first 345-kv substation at Goodings Grove, Ill., 27 miles southwest of Chicago's loop, forms the terminus of the 345-kv tie between the company and American Electric Power Co and joins the 345 kv into Commonwealth's 138-kv system.

The site was chosen because the 138-kv system has adequate capacity there for the 345-kv tie, and it fits into plans for further extension of the 345-kv transmission system into Commonwealth's territory. The 345-kv tie between systems is a double-circuit line about 90 miles long.

Continuous capacity of the tie will be 300,000 kw, initially, as fixed by the 330/138-kv transformers at Goodings Grove. For very brief emergency conditions, load could be 500,000 kw. The substation has been planned in steps.

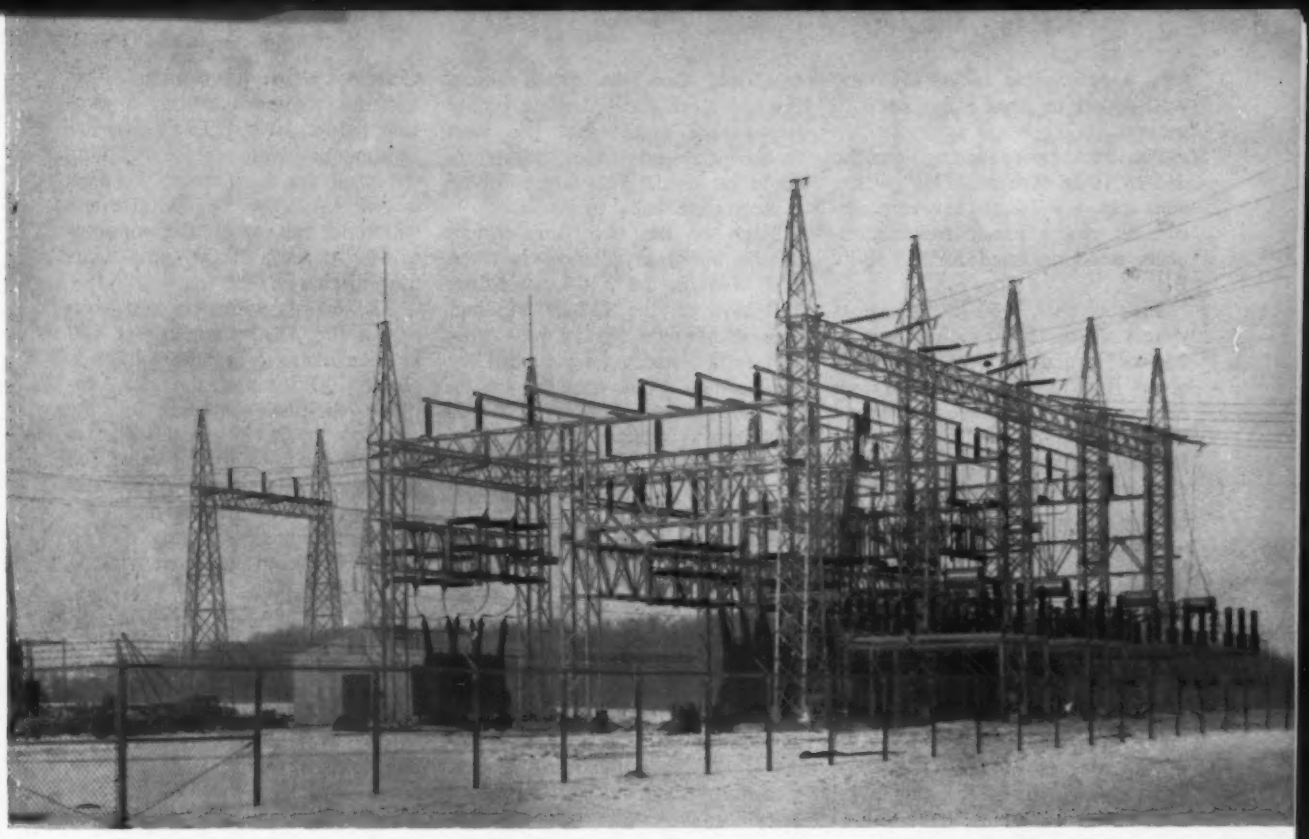
Two 345-kv and four 138-kv lines in the substation are now nearing completion. Each 345-kv line will connect to a 160/180—60 Mva, 330/138—12 kv 3-phase autotransformer. Two 62.5- kva, 12.6-kv, 3-phase synchronous condensers, one connected to the tertiary winding of each transformer, provide reactive power to the lines. The two transformers connect to a 138-kv bus which, in turn, connects to the four lines of the 138-kv transmission system.

There is no 345-kv bus nor 345-kv circuit breaker. Motor-operated, 345-kv disconnecting and ground switches can isolate the lines, but the transformer 138-kv circuit breakers are used for switching.

Plans call for six 345-kv lines connecting to a 345-kv bus sectionalized by a bus tie breaker. The four additional 345-kv lines will be part of the development of the 345-kv system within the Commonwealth system.

From each 345-kv bus, one circuit breaker will connect to a pair of autotransformers and associated synchronous condensers. The pair will connect through one 138-kv circuit breaker into the 138-kv bus. There will be four sections of the 138-kv bus with two 138-kv lines tapped to each section for a total of eight 138-kv lines.

Although there is little 345-kv equipment in the initial installation, the design was developed so that



ers at the site while construction was continuing. At that site CE's 138-kv system has adequate capacity for the 345-kv tie and location fits into plans for extending 345-kv system in accordance with the ultimate plan schematized below

Chicago Area's First at 345-Kv

the equipment could be added easily as required. As now planned, future additions will "slide under" the initial installation with a minimum of cutover time. The control house was set up between the 345 and the 138-kv switchyards to reduce the costs of conduit and control cable.

Sheer size is the chief novelty of the 345-kv structure which requires about four times the area and costs about three times as much as an 138-kv structure.

As no standards have been established for minimum clearances of phase-to-phase and phase-to-ground, the design was based on an analysis of previous 345-kv installations by other companies and of laboratory clearance studies. The chief requirement for the higher-voltage design was increased spacing so that flashover will occur phase-to-ground instead of phase-to-phase. There-

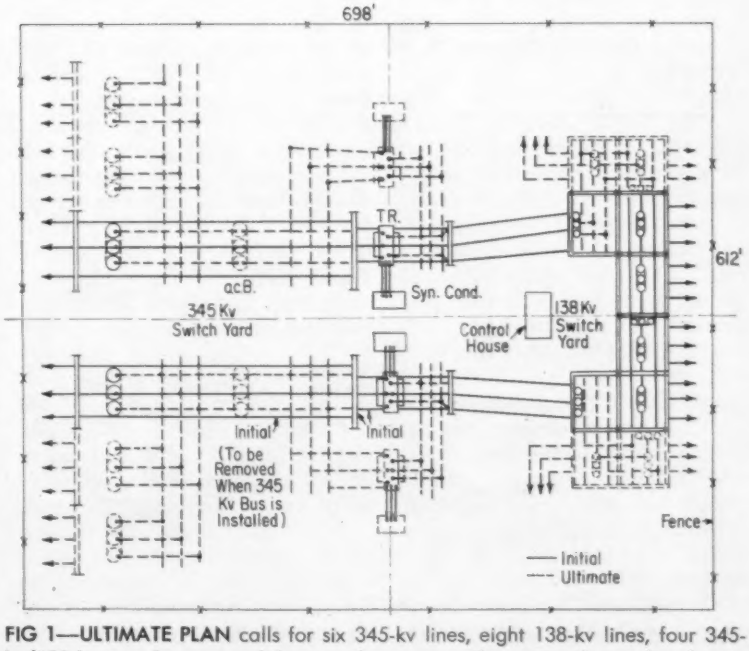


FIG 1—ULTIMATE PLAN calls for six 345-kv lines, eight 138-kv lines, four 345-kv/138-kv transformers and four synchronous condensers in the enclosed area

fore, a reasonable factor of safety was added to assure flashover to ground.

Phase-to-phase spacing on the 345-kv is 18 ft 6 in. This gives a clearance of 14 ft between disconnect switch parts. Bus disconnects were designed for 1,300-kv BIL.

In the past, 161-kv insulators were used on 138-kv structures as 138-kv insulators were not available. But 138-kv insulators were obtained for Goodings Grove and their use has reduced the spacings for the steel structure. This, in general, gave a more economical installation.

Another change from past practice for Commonwealth Edison was the omission of the 138-kv transformer bus, which also helped to reduce the cost of the installation.

Phase-to-phase spacing of the 138-kv bus is 8 feet, with 55 in. to ground. Aluminum tubing, 6 in. in dia., was used for this 138-kv bus. It was welded by the protective arc method.

Considerably smaller tubing would have had adequate current-carrying capacity and would have cost less than the 6-in. tubing. But the mechanical strength of the larger tube meant that less steel framework and fewer insulators could be used. The larger tubing is more economical to install.

Each of the two transformers of the initial installation is rated 160 Mva on the 330-kv winding, 180 Mva on the 138-kv winding, and 60 Mva on the 12.6-kv tertiary, delta-connected winding. They are 3-phase FOA transformers.

The autotransformer type of winding was selected because there were shipping problems involved in getting a two-winding transformer to the Goodings Grove site and some economies were effected.

Basic insulation level (BIL) of the 330-kv windings is 1,050-kv withstand. Plans originally called for transformers having an 1,175-kv BIL in the 330-kv winding because all 330-kv transformers in service were designed to that level. The economies possible with reduced BIL, and the trend in that direction prompted by improved lightning arresters and greater knowledge of the art, led to the change in specifications for the Goodings Grove transformers. This amounts to approximately a two-step reduction in BIL.

Maximum allowable lightning stress on the transformer windings is 840 kv. The 264-kv arresters will limit voltage on the windings to 800 kv for a 20,000 amp lightning discharge.

The 60-cps withstand test voltage of the 330-kv winding is 460 kv. As phase-to-ground voltage is about 200 kv and the phase-to-phase dielectric strength of the transformer is inherently greater than the phase-to-ground value, the transformer should have sufficient margin of dielectric strength for any anticipated switching surges.

The 138-kv transformer winding has 115-kv class insulation, a reduction of one step in the BIL. Here again economics dictated the decision to take advantage of advances in the art, particularly lightning arrester design and production, which have led to the trend to reduced transformer BIL. The external portion of the 330-kv bushings will have a 1,300-kv BIL withstand to conform to that of the bus and disconnect insulators.

The transformers are 31 ft high over the bushings and 23 ft in overall length. Each weighs 488,000 lb.

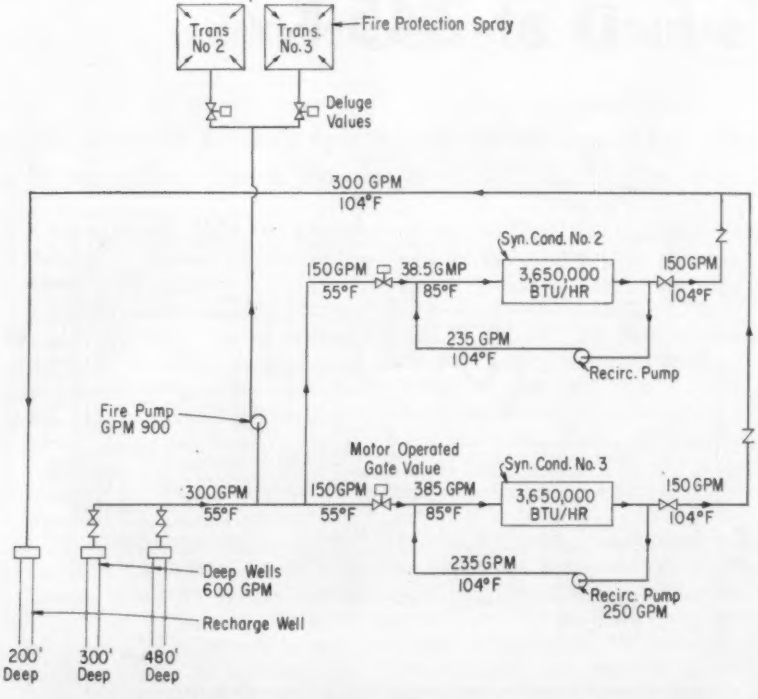


FIG 2—COOLING WATER for condensers is supplied by two deep wells and returned to a third or recharge well. Well water at 55F is tempered to required 85F

Arresters Rated 264 Kv

Lightning arresters for 345-kv protection are rated at 264 kv. In the past, large arresters were of the suspending, multiple type and required large areas and structures for their installation. The Goodings Grove arresters are self-supporting, station-type and are mounted on a steel stand. They were selected for ease of installation, space economy, and lower installed cost. They are the single-pedestal type. Although original plans called for arresters 17 ft high, design improvements reduced height to about 10 ft.

Two synchronous condensers were installed, one for each 345-kv line. These will supply reactive power to the system during heavy-load periods and absorb reactive power from the 345-kv lines during light load periods. Synchronous condensers were selected because they offer the most flexible and economical performance.

The condensers are completely

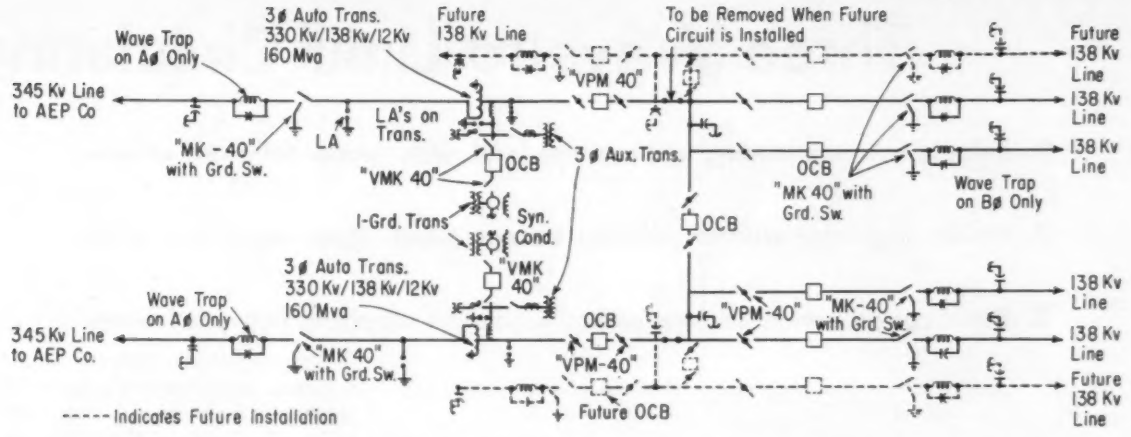


FIG 3—CONNECTIONS will be changed as shown above as the new 345-kv Goodings Grove substation is expanded later. There are four 138-kv lines out of the Goodings Grove substation. Two synchronous condensers are rated at 62.5 kva

enclosed and have shaft driven exciters in their gas-tight cylindrical shells. They are hydrogen cooled. Ratings are: 62,500 kva lagging output at 30 psi hydrogen, 12,600 v, 60 cps, 3-phase, 720 rpm. The excitation system includes an automatic voltage regulator.

As the condensers will run almost continuously and will be taken out of service only for faults and maintenance, across-the-line starting was selected. Such starting brings a substantial saving.

The decision to use across-the-line starting revolved around a determination of whether prevailing voltage conditions would be tolerable. They are expected to start only a few times a year, so that the conditions resulting from across-the-line starting are not expected to be objectionable. It was estimated also that the life taken out of condensers by the stresses created by such starting would not be great, as the starts would be so infrequent.

The condensers are started by supervisory control from the company's Will County station, 7½ miles away. Necessary readings on the condensers are telemetered to that station.

Armature coils are of the multi-turn type, rather than the single-turn, half-coil type. Armature and field insulation are Class B.

Maximum full-load losses of each condenser are 741 kw. The heat is removed from the hydrogen by water coolers. As there was no water supply at the Goodings Grove site, deep wells were driven. Cooling water is now supplied by two wells, one 300 ft deep and the other 480 ft deep. Each has a capacity of 600 gpm, and the well depths were determined by the capacity required.

Each well has a 600-gpm, constant-speed pump and sufficient capacity for the synchronous condensers. One well is used as a spare. Ultimately, a third well may be drilled.

Water is at 55F

Water comes from the wells at 55F. Desired temperature in the coolers is 85F. To obtain water at the proper temperature, water from the coolers is mixed with that from the wells, the mixture going to the coolers. Water from the coolers is discharged back into the water strata in the ground through another well 200 ft deep. This recharges the wells from which the water is drawn. All three wells are 12-in. cased down to the limestone.

A cooling tower had been considered. But, when the quantity and quality of water required was determined, the drilling of the two wells for supply and one for recharge purposes was found to be more reliable and economical.

The wells also supply water for fire protection of the transformers and for ordinary uses.

Goodings Grove is unattended. It is controlled from Commonwealth Edison's Will County generating station over leased telephone lines. Leased lines were chosen after a fixed cost evaluation showed a decided cost advantage over carrier equipment on the 138-kv lines.

The supervisory system controls all circuit breakers and the starting of the synchronous condensers. Necessary information for the operation of Goodings Grove is telemetered to the Will County station. The telemetered information includes various alarms. The supervisory and telemetering systems are entirely separate in operation.

Information for load control on the 345-kv lines is telemetered from the AEP's Olive substation, eastern terminus of the lines, to the Commonwealth Edison load dispatcher's office. This information is transmitted through a microwave and cable system. But, an emergency path is available through leased telephone lines from Goodings Grove. The telemetered values from Goodings Grove are used as a check by the load controller to control the Commonwealth Edison generation for a given schedule of power transfer.

The 345-lines are protected by carrier current directional comparison relaying with transfer tripping. Impedance and ground directional relays are used as backup.

The differential relay across the transformers at Goodings Grove will transfer trip the 345-kv breakers at the Olive substation.

Three Ways to Limit Circulating

1. Balance currents feeding into common load with leader-follower scheme

2. Leader regulator scheme provides voltage which other regulators follow

3. Equal-compensation scheme covers regulators supplying network feeders

H. C. GEORGE, Staff Engineer, Detroit Edison Co, Detroit, Michigan

Special regulator control circuits have been developed by Detroit Edison Co to limit circulating current in paralled regulators feeding a common load, such as a network. The special circuits:

1. Balance currents when feeding into a common load.

2. Balance voltage when regulators are tied through the impedance of network transformers.

3. Give equal compensation to regulators feeding a network area when each regulator is fed from a separate transformer and all transformers are fed from the same source.

Devised for 3-Phase Units

The first two schemes are of the leader-follower type. In the third, the regulators operate independently except for equal line-drop compensation. These circuits were devised for 3-phase-type regulators wound on a single core, in which circulating currents produce changes in phase angle as well as voltage magnitude.

In the current-balancing scheme in Fig 1, regulator No. 1 regulates for voltage only. While regulator No. 2 regulates for voltage also, it regulates primarily to reduce circulating current. When load currents are equal, voltages induced in line-drop compensators oppose each other. When circulating current exists, voltage drops in the two compensators add and cause regulator No. 2 to move in a direction to reduce circulating current. The 4:1 potential transformer increases the sensitivity to circulating current.

One feature of this current-balancing scheme is that the two regulator control panels are interconnected by a potential rather than a current circuit. If the distance is great and control-circuit resistance is large, resistance R_2 can be reduced to compensate for the increased circuit resistance.

In the equal-voltage scheme in Fig 2, the regulator on bus 11 acts as a leader. Other regulators are adjusted to follow the voltage on this bus. Compensator current, X_c-Z_c, from network feeder 12T feeds through the dpdt, make-before-break test switch on the regulator control panel of bus 11. The test switch normally feeds the primary of the 10/5 CT. The other switch position short-circuits this current and clears the network feeder position in case it must be shut down.

Compensator current from network feeder 85T is received through a similar dpdt test switch. Secondaries of the two 10/5 auxiliary CT's are paralleled across terminals U and S of the type KD line-drop compensator for bus 11. Potential of this bus is obtained from a 1.5-kva line transformer instead of the usual PT. A potential bus carries bus 11 potential as a reference voltage to each control panel of the other bus regulators.

Regulation is Sensitive

The 60-v winding of an auxiliary PT is connected from Z_p of the reference voltage to Z_p of the follower bus PT. X_p of each source is grounded. One lead of the 115-v winding of the PT is connected to the 60-v winding of that transformer to make an autotransformer. The other lead goes to terminal E of a voltage regulating relay, then to a line-drop compensator, and then to X_p. Difference between Z_p of the leader and Z_p of the follower is stepped up in the PT by the ratio of 60:115. This makes regulation of the follower regulator very sensitive to voltage changes on the leader.

An adjustable resistor is connected between the potential throwover switch and the voltage-regulating relay on the follower regulator. It substitutes for the compensation provided on the leader when the leader-follower scheme is not operating.

Receives "Average" Current

To provide regulators with equal compensation without excessive circulating current, the circuit in Fig 3 was developed. Feeds for all transformers in the substation should be from the same source in this scheme, which is a series-compensator type of voltage regulator control. Compensator currents, X_c-Z_c, from the CT's of network feeders to the same network grid are paralleled. They feed into the primary of an auxiliary CT having the same step-down ratio as the number of feeders involved.

Secondary of the auxiliary CT is connected in series with a dpdt, make-before-break test switch on each feeder position. The switch feeds current to the line-drop compensator or it may be thrown to bypass the compensator. In this way each compensator receives the "average" current of all feeders.

Voltage regulators are set to operate for the same voltages. Because feeders are practically all the same length, compensators have the same settings and regulators supply equal voltages to the network. If one feeder is opened, total current through the compensators remains the same and output voltages do not change.

Current in Paralleled Regulators

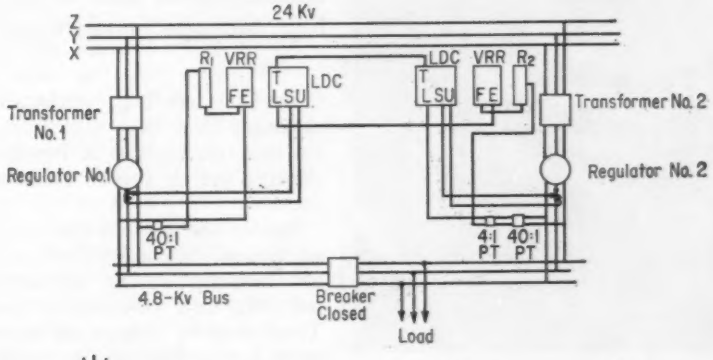


FIG 1—CURRENT-BALANCING CONTROL uses a leader-follower scheme in which unit No. 1 regulates for voltage and unit No. 2 regulates primarily to hold down the circulating current

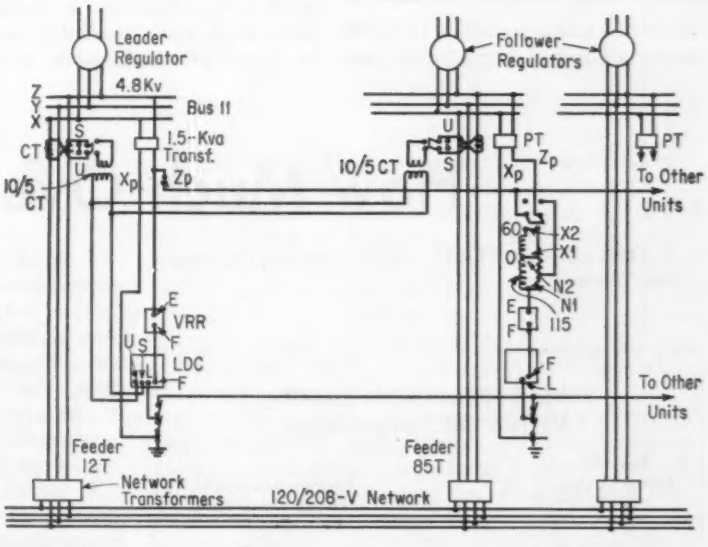


FIG 2—EQUAL-VOLTAGE CONTROL provides for bus 11 regulator to act as the leader. Other regulators receive a reference voltage which causes them to follow the voltage held on bus 11

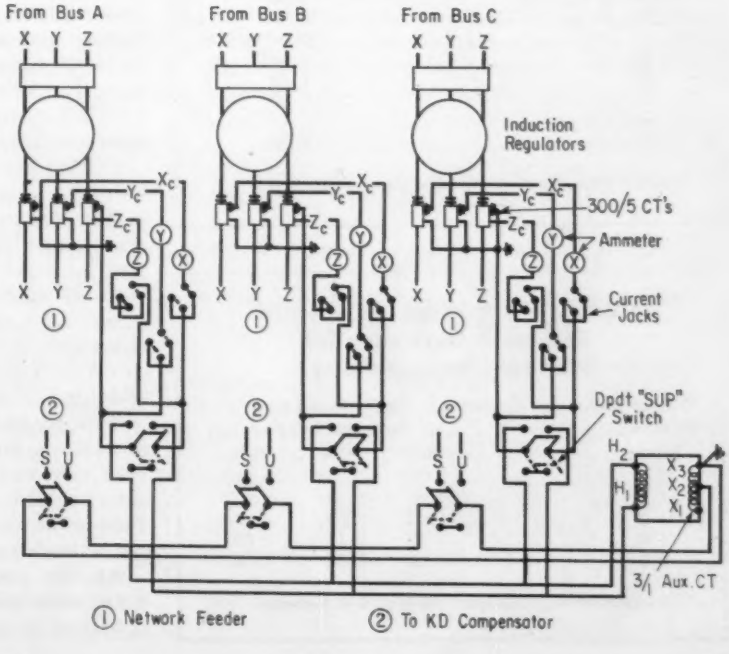
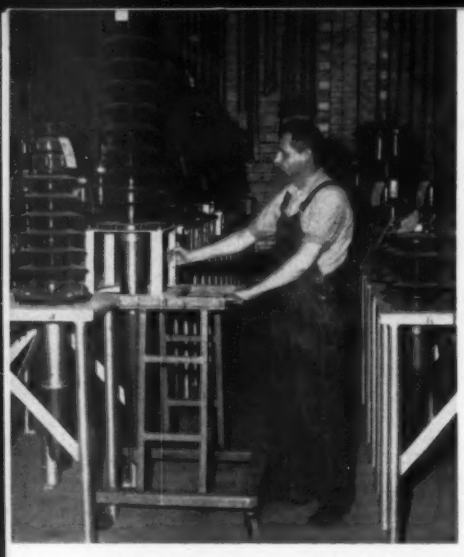


FIG 3—EQUAL-COMPENSATION CONTROL feeds all compensators with the "average" current of all feeders. Regulators are compensated to supply equal voltages to the network



BUSHINGS are mounted on 18 by 18 in. plates adapted to spacing on carts

Bushing Handling

Special racks and carts at Houston L&P facilitate handling, storage, and repair of the complete bushing stock

Bushing handling, storing, and repairing have been simplified by the Houston Lighting & Power Co through use of special racks and carts.

Before the introduction of this equipment, carpenters built crates for bushings to be shipped or handled. This took several hours. There was no convenient way of holding the bushing in position while work was done on it, except to stand the bushing in a hole through a table. But, it was hard to put the bushing in and out of the hole. This required blocks.

When new storage facilities and shops were being considered, special steel plates were developed for mounting bushings. They are 18 in. square and have holes in the center. An assortment of hole sizes accommodates the complete bushing stock. The edges of these plates are turned down so that they slide over the edges of properly spaced Unistrut

How Much Overload Can Your

H. C. BREM and **R. A. STUDER**, Allis Chalmers Mfg Co, Milwaukee, Wisconsin

Table I—Permissible Loading Vs Top Oil Temperature

Top Oil Temperature, Deg C	Permissible Loads, Times Rated Kva
35	1.99*
40	1.88*
45	1.77*
50	1.66*
55	1.54*
60	1.42
65	1.29
70	1.15
75	1.00

*Factors other than insulation life may limit overload

Table II—Permissible Self-Cooled Regulator Overloads for Normal Life Expectancy

Overload Duration, Hours	Times Rated Kva for Initial Load of 90%	70%	50%
0.5	1.59*	1.77*	1.89*
1.0	1.40	1.54*	1.60*
2.0	1.24	1.33	1.37
4.0	1.12	1.17	1.19
8.0	1.06	1.08	1.08

* Factors other than insulation life may limit overload

Continuing efforts are being made by utilities and manufacturers to get the most out of investment in facilities. All types of equipment have come under close scrutiny to determine permissible overload, and voltage regulators are no exception. In determining permissible loads for regulators, there are three areas to consider:

1. Physical limitations.
2. Type of guide for setting allowable overload.
3. Effects of overloading on insulation life.

In considering the area of physical limitations, these factors should be kept in mind. Oil expansion resulting from rising temperature and the accompanying pressure built-up may seriously damage the regulator. Bushings and leads must have the ability to take overload without damage. Although crimped terminals now replace soldered control connections, older soldered connections are subject to damage from overloading.

Driving mechanism of an induction regulator may be damaged as a result of greater torque caused by higher loading. Control-equipment coupling-current transformers or line-drop compensators to each regulator also may be damaged by overloads. Thermal limits of windings, loading limits of associated equipment, and current-carrying capacities of tap-changing equipment in step-type regulators should be watched carefully. Loading above 150% of rating may mean added maintenance, particularly for contacts.

With physical limitations in mind, the next step is to select the type of guide for allowable overload. The basic rule used in the "loading by measured temperature" guide is this: So long as the hottest-spot temperature of the winding does not exceed 95C, the regulator can be loaded above its rating for any period of time.

Another guide to safe overloading is the top-oil-temperature guide. Allowable multipliers of rated kva at various oil temperatures are listed in Table I. This

Made Easier

members which form the tops of bushing storage racks and bushing carts. The plates are held in place by their turned-down edges.

Steel storage racks of two different sizes were built to hold the bushings. Medium size and large bushings are stored one to a rack. Small bushings are mounted two or more to a plate and stored one plate to a rack. Racks have steel pipe-type legs with bracing on the back and sides. The front is left open, without bracing, so that bushings mounted on the holding plates slide into place. The tops of the storage racks have two Unistrut members spaced to take the plates on which the bushings are mounted. The curved edges of the plates fit over the Unistrut members and hold them in place.

The carts are simply racks on wheels and open at the front. The top of the cart has two Unistrut members matching those on the racks. The plate on which the bushing is mounted slides from the storage rack to the cart. It is moved on the cart to another storage rack, to a truck for hauling, or into position for maintenance work.

Matching of plate size to rack and cart, and the sliding motion of the plates moved from cart to rack or rack to cart, explain the easy procedure. Paraffin lubricants are used on the plates and members.

LOADED CART moves easily. There are extensions for the longer bushings

Regulators Take?

guide and others are a part of the complete "Guide For Loading Oil Immersed Step Voltage and Induction Voltage Regulators", ASA Appendix C57.95.

If the winding-test temperature rise can be determined, another guide may be used. The regulator can be operated at 1% above its rated kva for each 1C that the maximum winding-test temperature is below the normally-allowed 55C rise. A 2C cushion should be used to allow for errors in determining temperature rise.

As ambient temperature increases above the average 30C (86F), permissible regulator loading decreases 1½% for each 1C rise in temperature. Likewise, for each 1C decrease in ambient temperature below 30C, permissible regulator loading can be increased by 1% above its kva rating.

When the load factor is below 100%, the loading-load factor guide can be applied. Maximum loading for an equal and subsequent period may be increased 0.5% above rated kva for every 1% the load factor is below 100%. However, maximum increase should not exceed 25% and period should not exceed 24 hr.

The last factor is effect of overloading on insulation life. On the basis of retaining normal life expectancy of self-cooled regulators, permissible percent and duration of overloading for initial loadings are shown in Table II. Loss in insulation life for various overloads and time periods is given in Tables III and IV. For loadings over 150% of rated kva, limiting factors other than insulation life must be considered.

To determine the permissible overload for any regulator, provide the manufacturer with the regulator rating, serial number and original delivery date. He will supply information on oil expansion and pressures, bushing capabilities, leads and soldered connections, thermal rating of windings, tap changer characteristics, type of control equipment, torque limits (for induction regulators) and contact erosion limits. These data must be tempered by thermal capabilities of associated equipment, temperature of the unit and top-oil temperature, temperature rise, ambient temperature, load factor and short-time loads. From all these data a practical and workable guide for overloading the regulator may be developed.

Table III—Overloading Vs Insulation Life Loss, 50% Initial Load

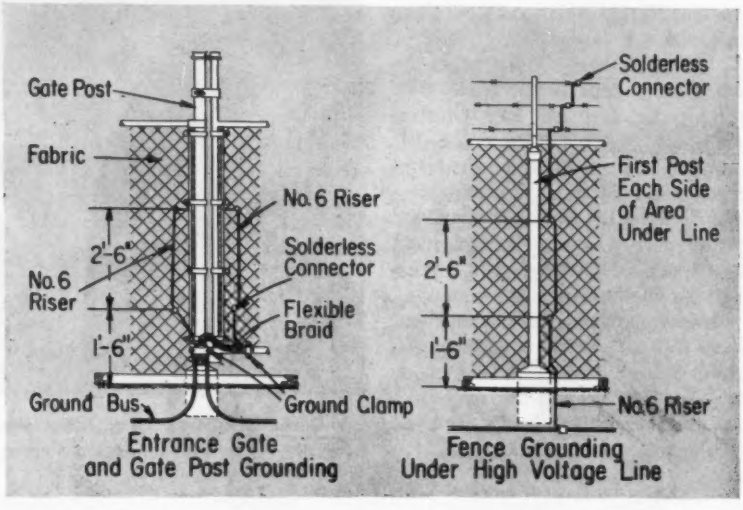
Overload Duration, Hours	Permissible Overload, 0.1% Insulation Loss	Times Rated Kva, for 1.0% Insulation Loss
0.5	2.00*	2.00*
1.0	1.76*	2.00*
2.0	1.50	1.82*
4.0	1.27	1.53*
8.0	1.13	1.37
24.0	1.05	1.23

* Factors other than insulation life may limit overload

Table IV—Overloading Vs Insulation Life Loss, 100% Initial Load

Overload Duration, Hours	Permissible Overload, 0.1% Insulation Loss	Times Rated Kva, for 1.0% Insulation Loss
0.5	1.75*	2.00*
1.0	1.54*	1.92*
2.0	1.35	1.68*
4.0	1.20	1.48
8.0	1.11	1.35
24.0	1.05	1.23

* Factors other than insulation life may limit overload



GATE POSTS are solidly grounded with flexible braid. Barbed wire strands are grounded under each side of high voltage lines with solderless connectors

Modernize

J. E. HOOPES, Electrical Engineer, Kansas City Power & Light Co, Kansas City, Missouri

Increased safety is the object of new substation fence and vault grounding practices developed by Kansas City Power & Light Co. Fence grounding is especially critical, because of the possible hazard it might present to the public and company personnel during fault conditions on the system.

The standard substation fence is a 6-ft chain link fabric with a top rail and with three strands of barbed wire above the rail. Fence posts are located about every 10 ft. The former practice of grounding every fourth post and the top rail at the

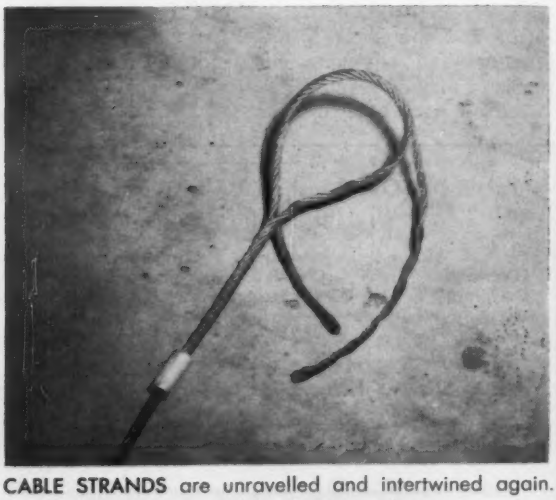
Make Winch-Line Loops in 6 Minutes

EUGENE A. GRIM, Lineman "A", Indiana & Michigan Electric Co, Muncie, Ind.

One man can make a high-strength winch-line loop in about 6 min using a method developed by Indiana & Michigan Electric Co. It requires only standard line tools available on most trucks.

The cable strands are unravelled, looped back, and intertwined again. A sleeve is compressed over the ends to hold strands in place. Any strain on the loop causes the strands to grip tightly against each other but puts very little strain on the sleeve. Destruction tests exceeded rated cable strength before failure.

Previous use of serving wire to form loops was not as satisfactory, because of a tendency of the wire to loosen. The improved cable loop has never slipped or failed. Tests exceeding cable strength were insufficient to break the loop.



CABLE STRANDS are unravelled and intertwined again. A compression sleeve holds strands in place

STANDARD LINE TOOLS available on most trucks are used to make an improved cable loop in 6 min

Substation Grounding Practice

same location was costly. Because the posts are tied to the fabric with aluminum wire, the company decided not to ground the posts but to ground the fabric every 40 ft.

Because of low ground resistance, the company ties the fence in solidly to the station ground. For small station areas, a No. 6 copper riser is extended to the fence very 40 ft. On the larger stations, a No. 2 fence ground is extended around the inside of the fence with No. 6 copper risers to the fence every 40 ft.

In place of grounding the top rail on each side of the incoming high voltage line, present standards call for grounding each strand of the wire using split bolt connectors. The top rail, like the post, is tied to the fabric every 2 ft by aluminum wire. This multiple tie should drain off any static charge on the top rail.

On each side of the entrance gate, the pipe frame for the gate is grounded with a flexible wire strap running to the grounded gate post. Personnel contact with the gate and lock makes effective grounding mandatory.

A change in grounding practices has been required in substations for small industrial customers where the station is located in a vault on the customers' premises. In the past, grounding was attempted either by installing a grid before the vault slab was poured, or by having the customer install pipe sleeves in the slab. These were unsatisfactory because of rock underlying the slab and other difficulties.

Now, a 250-MCM ground wire is installed in the same trench with the power cable; four ground rods are evenly spaced along the wire. Inside the station a ¼x1-in. ground bus is installed around the wall near the floor. This bus is extended from the wall by 1-in. spacers so that taps can be made to equipment. The customer extends a 250-MCM ground wire from the street side of the water meter to this bus and also uses the bus for his secondary grounding. The primary neutral, as required, is brought in on the ground bus.

Truck-Mounted Auxiliary Supplies AC, DC

HOWARD J. WURTH, Commonwealth Associates, Inc, Jackson, Mich.

A combination ac and dc engine-generator, mounted in a line truck, provides power for floodlights, warning lights, radio, power tools, cab heating, and battery charging. The unit supplies 300 w of dc and 3 kw of 115-v, 60-cps, ac power.

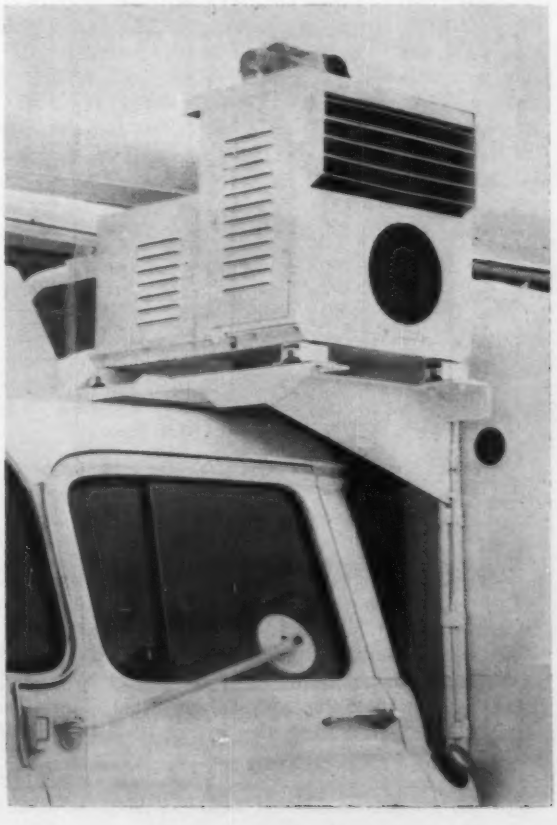
Both the ac and dc generators are mounted on an integral extension of the engine crankshaft. An air-cooled engine was selected because of its low cost, light weight, and lesser maintenance problems. The engine is equipped with oil filter, oil bath air cleaner, magneto ignition, radio shielding, and mechanical governor.

In addition to its operating duties, the dc generator starts the unit. A voltage regulator and reverse-current relay protect both truck charging circuits.

"Airplane type" electric heaters, with integral fan, are used in the cab and crew compartment. To avoid overloading the generator, a throwover switch disconnects the heaters when the circuit for power tools is energized. For safety, neither side of the ac line is grounded, although the alternator frame is grounded to the truck frame.

Originally, the unit was mounted on the cab as shown. Noise problems caused the transfer of the unit to within the body, where more effective noise reduction steps could be taken.

Present control circuits prevent simultaneous operation of truck engine and auxiliary. This is being altered to permit the auxiliary to help start the truck engine from a nearly discharged battery.



Find Heater Kw Rating to Heat Storage Tank*

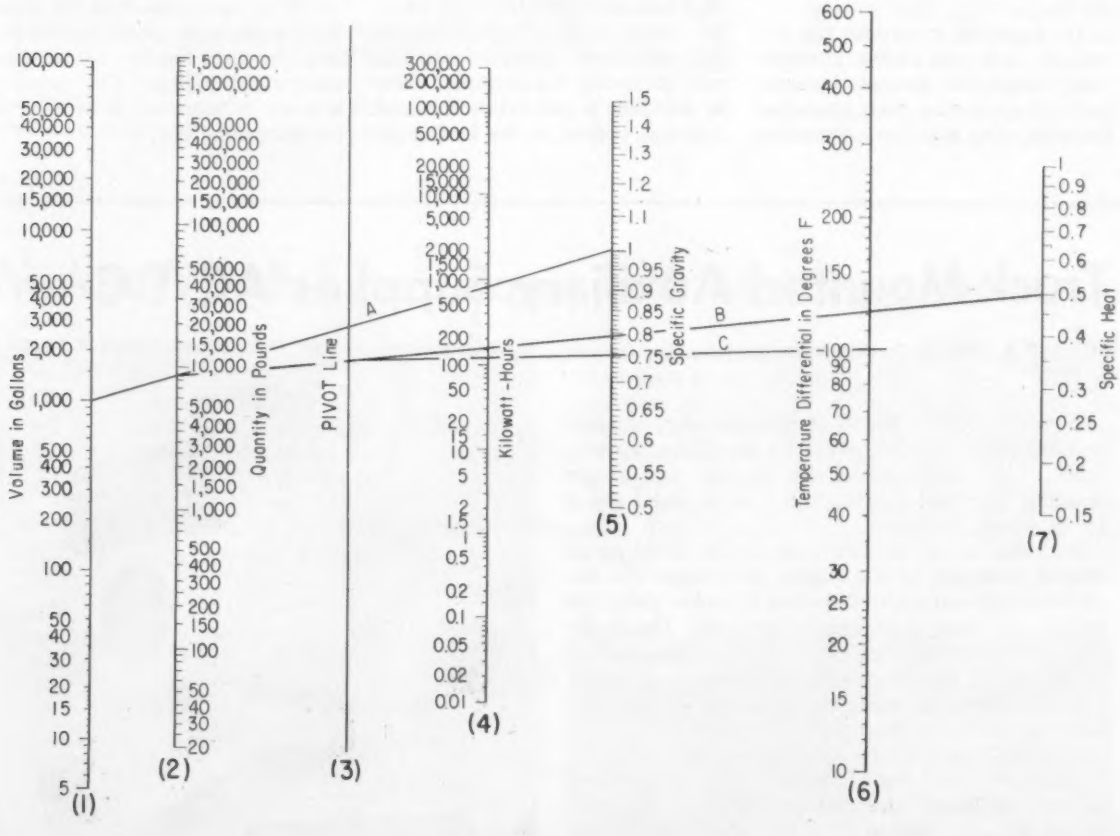
This nomograph was prepared by engineers of Hynes Electric Heating Div, Turbine Equipment Co, Mountainside, N. J. It is designed for fast calculation of heater size, that is electric power in kilowatts (kw), required to bring a tank of viscous liquid to a specified temperature in a specified time.

The nomograph solves the equation:

$$\text{Kwh} = \frac{Q}{3415} = \frac{V \times 0.134 \times p \times 62.5 \times C_p \times \Delta T}{3415}$$

where: Kwh = kilowatt-hours
p = specific gravity of the material
V = volume of material in gallons
C_p = mean specific heat of the material in Btu/lb/deg F
ΔT = temperature differential in degrees F
Q = Heat required in Btu

Having determined the electrical energy in kilowatt-hours and knowing the time available for heat-up the appropriate size heater can be obtained.



EXAMPLE

REQUIRED: The rating of a heater to raise 1,000 gal of a liquid whose specific gravity is 1.0 and specific heat is 0.5 from 50F to 150F in 3 hr.

Step 1—Determine the weight of the liquid (not necessary if weight of material is known) by joining 1,000 gal on scale (1) with 1.0 on scale (5) by the straight line (A) reading the weight of 8,400 lb on scale (2).

Step 2—Connect the above reading on scale (2) with 0.5 on scale (7) by the straight line (B).

Step 3—Connect the intersection of line (B) on scale (3) with 100F on scale (6) by the straight line (C) and read 120 Kwhr on scale (4).

Since a total energy input of 120 kwhr is required, and tank content is to be heated in 3 hr, a heater rated at 40 kw will be needed.

*Heater size to maintain storage tank temperature can be determined by a nomograph which will appear in a subsequent issue of Electrical World.

Keep an Eye on Oil and Insulation

The following is adapted from the Substation Maintenance Workshop prepared and conducted by the Industrial Sales Dept of West Penn Power Co for its larger industrial customers. Two additional articles, covering maintenance of breakers and protective equipment respectively, will appear in later issues of EW.

Insulation is one of the weaker links in an electrical system. Because its failure almost always results in equipment downtime and may have even more disastrous results, vigorous preventative maintenance is required.

To assure proper operating of costly transformers and breakers, reduce maintenance costs and failures, and maximize equipment life, it is essential that the insulating oil used in these equipments be kept in the best possible condition. The main causes of deterioration and contamination of oil are moisture, carbon, oxidation, and contact with foreign matter.

In normal operation, temperature changes will allow some moisture and air to enter a free-breathing transformer. Some of this moisture will settle harmlessly to the bottom of the tank and may be drained off during an inspection. Moisture that remains in suspension lowers the dielectric strength of the oil—the voltage at which it breaks down—and attacks the insulation on the windings.

In a breaker, both the suspended particles and the water in the bottom may be trouble sources. Since a breaker does not normally generate any heat, the water in the bottom may freeze in cold weather. The ice then floats to the top where it may interfere with operation of the mechanism or provide a flashover path. Free moisture in a breaker will also be absorbed by any carbon present, thus forming a leakage path and causing a flashover.

In the presence of heat and oxygen, some components of the oil produce acids, which in turn form sludge. This is deposited in the windings of a transformer, preventing the oil from circulating freely in the ducts, and interfering with the cooling. The core then begins to heat up, starting new oxidation cycles, which ultimately may result in failure of the transformer.

Sludged oil can be reconditioned chemically, but this is an expensive process. As long as the neutralization number is kept low, sludging does not occur. Oxidation is much slower if an inhibited oil is used or if the transformer is a sealed, nitrogen-filled type.

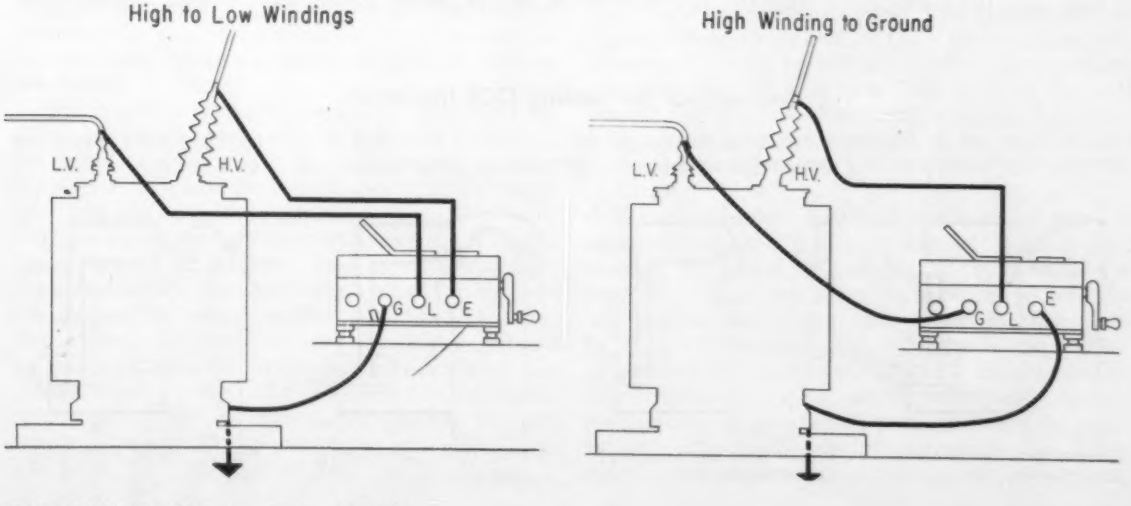
When an energized breaker is opened, the arcing between the contacts burns the oil in the immediate vicinity and produces carbon which spreads through the oil and in time settled on everything in the tank. Carbon may be effectively removed from the oil by a filter press or by a centrifuge press combination. Deposits inside the equipment may be removed by wiping with rags and washing with oil. Lint, dust, dirt, and other foreign particles are not as common a cause of failure as water and oxidation and may be removed quite effectively by filtering.

Facilities for testing oil are available through most large electrical manufacturers and at various commercial testing laboratories. The two most important of these tests are dielectric strength and neutralization number. If the oil satisfactorily passes both these, it will probably be all right for use; the other tests may be used if the results of these two are doubtful.

Since the most frequent cause of low dielectric strength is moisture, for all practical purposes, a high dielectric strength indicates the absence of moisture. It does not indicate whether the oil is oxidized or forming sludge.

The neutralization number measures oil acidity. It

Connections For Testing Transformer Insulation



is the number of mg of potassium hydroxide required to neutralize the acid in one gram of oil.

The pour point is the lowest temperature at which the oil will flow. A low pour point is especially important in transformers and breakers located outdoors and subjected to cold weather.

Power factor is the ratio of the power in watts dissipated in the oil to the product of effective voltage and current in volt amperes. It indicates the dielectric loss and thus the dielectric heating. An increasing power factor indicates a decrease in resistance, caused by moisture, a mixture of asphalt compounds, suspended carbon, oil-soluble varnish, or solutions of other insulating compounds.

The interfacial tension is the force in dynes per cm necessary to pull a platinum ring upward through an oil-water interface. Oil with a low reading is usually contaminated with oxidation products.

Steam emulsion tests measure the time in seconds in which water separates from oil. A low value allows water to settle to the bottom quickly.

Acceptable values for these tests are summarized below:

Test	Good	Bad
Dielectric Strength	> 25 kv	< 20 kv
Interfacial Tension	> 45 dynes	< 18 dynes
Neutralization Number	< 0.03	> 0.5
Pour Point (Outdoor Equipment)	< −20F	> −20F
Power Factor	< 0.05%	> 1%
Steam Emulsion	20 to 30 sec	100 sec

Test Kits Provide General Indication

A field test kit which recently became available makes checking for acidity rather easy and also includes a polar compound spot test for interfacial tension. Although it does not give exact numerical measurements, it provides a good general indication. Its cost is no more than a chemical analysis of one oil sample and it can be used a number of times. It has been tested by our chemists, who found it accurate and easily interpreted.

Another kit used in our shops determines oil acidity by a color test. It, too, is easy to use and interpret. If tests with these kits and a dielectric test indicate that the oil is unsatisfactory, then perhaps a chemical analysis is in order.

The oil sample must be clean and carefully taken or it will not be representative of the entire lot. The container used should be glass or tin, with either cork stoppers or a screw cap, fitted with a cork insert. A tin or aluminum foil facing on the cork is even better. After each use, the facing, or the cork if no facing is used, should be replaced, the container cleaned with petroleum naptha, and air-dried in a warm, dry room. The covers are then replaced and the containers stored in a warm, dry room. If this procedure is impossible, at least be sure the container is reasonably clean and then rinse it out with new oil.

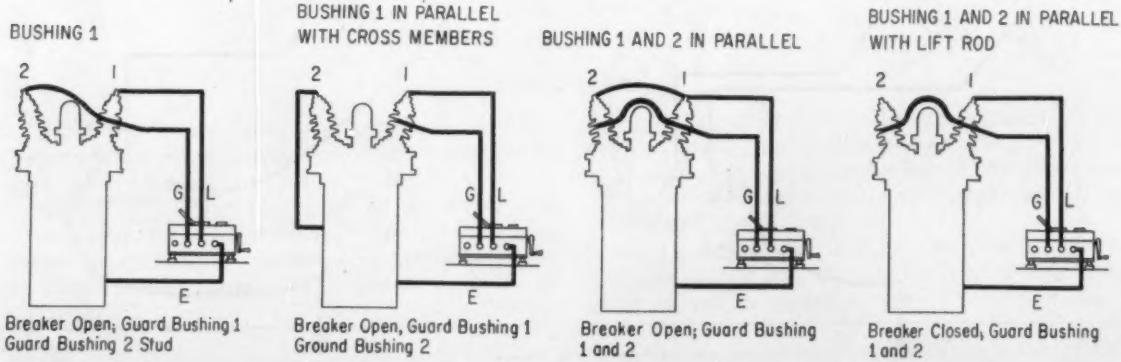
Take Sample on Dry Day

Take the sample on a clear, dry day. The sampling container should be warmer than the surrounding air to prevent condensation. When the sampling valve is first opened, let at least a quart of oil run into another glass container. Examine it for traces of water. Keep sampling until a specimen with no water is obtained. Then fill the sample container, cap it, and run the tests as soon as possible. Merely breathing into the container or touching the inside with your finger may introduce enough moisture to lower the dielectric reading considerably and give a false result.

Cable insulation should be inspected visually as often as possible, to detect weak points where water, oil, or acid is causing deterioration or where the insulation is drying out and cracking due to heat or aging. Any defect should be investigated and repaired immediately. Minor damage can be repaired with good electrical tape; more extensive defects usually require cable replacement. After making repairs, track down the cause of the damage and try to eliminate it. Otherwise, the trouble will keep recurring.

To check cable in conduit and to detect defects which are not readily visible, an insulation testing instrument such as the Megger is usually used. When new equipment is installed or cable run, the insulation should be measured and the reading recorded, along with the weather conditions at the time. Similar readings should be recorded at least once a year. If, after corrections for weather and temperature, the tests show a radical change at any time, prompt action should

Connections For Testing OCB Insulation



Breaker Open; Guard Bushing 1 Guard Bushing 2 Stud

Breaker Open, Guard Bushing 1 Ground Bushing 2

Breaker Open; Guard Bushing 1 and 2

Breaker Closed, Guard Bushing 1 and 2

be taken. The trend of the curve may be more significant than the values themselves. Since cleanliness is one of the principal variables affecting insulation resistance, this instrument also serves as a gauge of cleanliness.

An instrument whose terminal voltage rating is too high will damage the insulation. Use a 500-v instrument for equipment rated 600 v or less and a 1,000-v unit for higher ratings. Instruments without a speed-limiting clutch will generate a higher voltage if cranked too fast. This should be avoided.

All other equipment should be disconnected from the apparatus being tested. If this is not feasible, the report should tell what other equipment was included in the resistance reading to avoid misleading results and comparisons.

The instrument should be placed on a firm, even base, and levelled, if necessary. Avoid large masses of iron or strong magnetic fields. If the instrument has a selector switch, set it on the "Divide by One" ratio. With no leads connected, the pointer should move to infinity when the crank is turned at normal speed.

Apparatus Temperature Affects Reading

Check the zero by short circuiting the terminals and cranking slowly. Attach the leads to the instrument but leave them lying on the ground, with the distant ends separated and insulated from ground. If the reading is less than infinity when the crank is turned at normal speed, the leads have leakage paths which must be removed. Touch the test ends of the leads together to make certain there is no break in them. The leads should have polarity markings—Line, Earth, Guard—on them for quick identification.

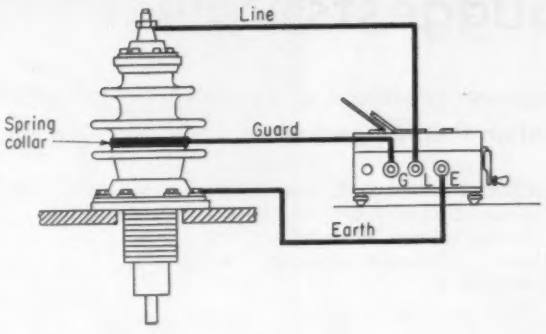
A reading is worthless unless the apparatus temperature is included in the report. The insulation resistance decreases rapidly with an increase in temperature. For example, if a transformer tests 60 megohms at 50 C, then at 20 C it should test 492 megohms. Readings are normally corrected to a base temperature of 20 C (68 F) to permit reliable comparisons from year to year.

In resistance measurements, the time required for the reading to reach a maximum is very important. The dielectric capacitance of the insulation is usually changed in a few seconds. However, because of the dielectric absorption effect, it may take minutes or even hours before the pointer reaches an absolute maximum.

For short-time readings, operate the instrument for either 30 sec or one min and take the reading at the end of that period. Continue cranking at a steady slip speed until the reading is taken. Make future tests with the same time interval.

Where no previous readings are available, the dielectric absorption effect may be used as an indication of the insulation condition by taking a set of two or more readings at one time. Insulation which is clean, dry, and in good condition shows an appreciable increase in resistance with the continuous application of test voltage. To make this test with a hand-cranked instrument, operate the instrument continuously for one minute. Read at 30 sec and at the end of the one-min period. Record both readings for comparison.

Connections For Bushings, Potheads, Insulators



With a power driven instrument, test for ten minutes, taking readings at one minute intervals. On large or very important equipment dielectric absorption curves may be made by taking readings every minute and plotting time against megohms.

The following ratios may be used as a rough guide to the amount of moisture and dirt present. The 10/1 minute ratio is known as the Polarization Index.

Condition	60/30-Sec Ratio	10/1 Min Ratio
Poor	< 1.1	< 1.5
Questionable	1.1 to 1.25	1.5 to 2
Fair	1.25 to 1.4	2 to 3
Good	1.4 to 1.6	3 to 4
Excellent	Above 1.6	Above 4

Index Varies With Humidity

Under high absolute humidity, armatures and fields of d-c rotating equipment, which have many leakage surfaces, may have Polarization Index values at least 25% above those in the table. In such cases, more normal values can be obtained by testing equipment when its temperature is much higher than ambient. Neither ratio will ever be less than one unless carbonized paths develop within or on the insulation as a result of the test voltage.

The Polarization Index values may also be used in testing oil-filled equipment such as transformers. However, since these measurements will include the resistance of the oil as well as the solid insulation, any deterioration in the oil will be reflected in the measurements for the solid insulation. The values in the table assume that the oil is dry and relatively free from acids and sludge. The condition of the bushings and terminal boards involved will also affect the Polarization Index.

The guard circuit is used to eliminate the effect of unwanted parallel circuits from the reading. For example in measuring the internal resistance of a bushing, surface leakage will show up as another resistance in parallel and cause a false reading. Similarly, on a transformer, the path from high-to-low-to-ground will give an erroneous reading when measuring high-to-ground only. In general, the reading on any portion of an apparatus will be higher when the guard is used. The basic principle is easy to remember: guard anything you are not testing.

Suggests Power Plant Criterion

Engineer-professor, commenting on EW editorial, proposes station thermal performance as an allowable measurement

THEODORE BAUMEISTER, Consulting Engineer, General Public Utilities Corp; Stevens Professor of Mechanical Engineering, Columbia University, New York, N. Y.

The editorial, "What's the Best Way to Compare Power Plants?" (EW, May 19, 1958, p 65) is provocative for anyone associated with the power industry.

Many attempts have been made to find a single criterion which would serve, like the gold standard in monetary matters, to measure the performance of a power plant. Despite the efforts, no one criterion has been found which would give the true measure of worth.

Discount Providential

Investment per kw of capacity, production cost per kwhr of output, percent thermal efficiency, heat rate in Btu per kwhr, and total cost of energy output per kwhr are all typical of the effort. Each has merit; each its own shortcomings.

It is gratifying to be the owner or operator of the power plant which shows the lowest investment in dollars per kw; or the one with the lowest labor cost per kwhr; or the one with the top thermal performance expressed either as heat rate or thermal efficiency. If you are fortunate enough to excel in any of these or similar areas, you will be justifiably proud of the accomplishment. But exemplary accomplishment in any one, or in several of these areas simultaneously, does not necessarily mean that you are doing the best possible job; that you have won your *summa cum laude* in the power business.

Providence may have placed your plant in a region blessed with an abundance of fuel or where fuel is available at a minimum price. Or you may have the advantage of low labor costs, cold condensing water, high load factor, and so on *ad infinitum*. What we would like to have is a criterion for judging merit in fuel-burning plants, which would be a better measure of design, operating, maintenance, and management skill. That measure should strip out the elements which are providential and leave only those features which are under the control of the designer and operator.

It can be properly said that the development of a single-performance standard is outside the range of reality. Despite the efforts to make the "wish the father to the thought," we are compelled to settle for something less than perfection. We may have to be content with the continued use of a multiplicity of criteria. But we may so alter or so redefine our criteria as to give a better measure of value on some particular phase of the power economy.

For example, we may introduce the concept of a station performance factor, which compares the actual station heat rate with a standard or bogey that might be specified. This is difficult because of the problem of duplicating the actual and the standard operating conditions in all details.

Usefulness Is Limited

If the factor were used within a single organization, where the specifications could be written rigorously and authoritatively, the station performance factor could have some merit. But to try to extend it to all power plants would lead to all sorts of differences of interpretation. As the factor is relative rather than absolute, its utility would be further limited.

Scrutiny of the several criteria which are variously used in power practice thus leads to the conclusion that we will have to continue to employ many different criteria—each with its own field of utility and its own limitations.

There is, however, one spot where the industry may well consider a change or permissive alternate. It has to do with the thermal performance—heat rate and thermal efficiency—and the old question of heating value of the fuel, high or low? This is not a new problem by any means. The high-low heating value argument has been waged for generations, and still there is no agreement. Fuel users in this country employ the high heating value; in Europe, they employ the low heating value.

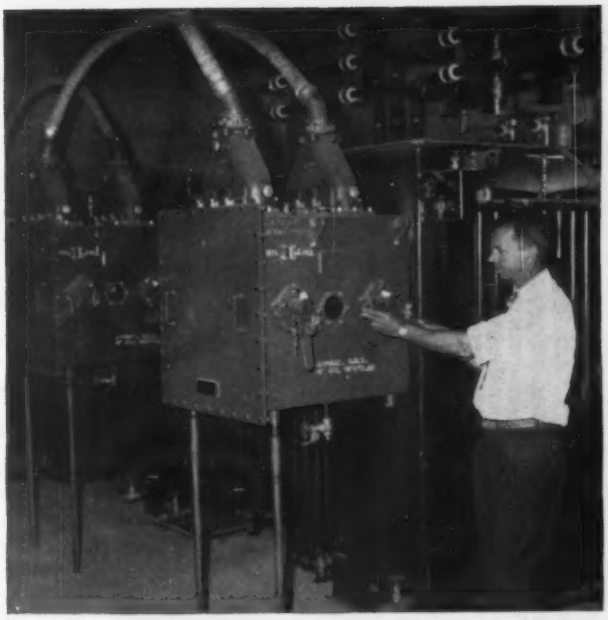
The difference hinges about the latent heat of the water vapor in the products of combustion. Shall the water vapor resulting from the burning of hydrogen in the fuel be considered to be in the liquid or vapor phase? Calorimeters measure the high heating value directly. The water vapor has given up its latent heat. The low heating value is computed from the observed high heating value. With natural gas this can lead to a difference of 15% in the Btu per cu ft or Btu per lb. With oil it is somewhat less, and with pure carbon it is, of course, zero.

Why Penalize Gas?

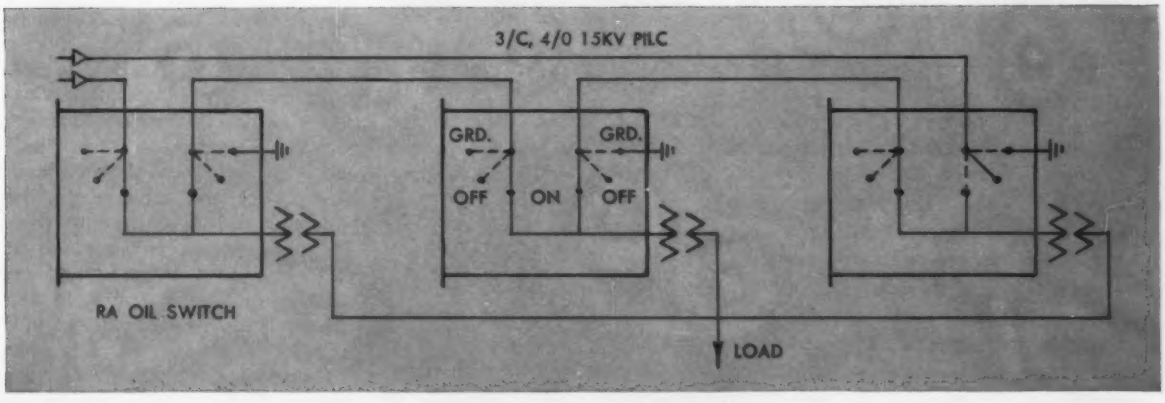
No boiler, no internal combustion engine, no gas turbine ever operates to condense the water vapor which appears in the products of combustion. So why should not the low heating value be used, as in Europe, for the thermal performance of such power plants? Gas engines are regularly judged on this basis even in American practice.

Why should a good steam power plant be penalized by as much as 500 Btu per kwhr, just because it happens to burn gas? Would we not do well to follow the precepts of the gas engine art and base all our thermal power plant performance on low heating value of the fuel? This need not be mandatory, but it could at least be made allowable.

Such an allowable adoption of the low heating value in American power plant practice would certainly disturb the practices and the equanimity of a large segment of the power and the fuel industries. There is, however, much merit to the low calorific value as a criterion for judging heat rate and thermal efficiency. Its use would do much to void the vagaries of providential good fortune. Some power plants, which could otherwise never reach the top on a list of the most efficient stations, might be given the recognition they deserve.



LOOP AROUND COSTLY SERVICE INTERRUPTIONS



Expensive service interruptions to a large building are minimized by looping feeder cables through G&W RA oil switches. The load is supplied by a southern utility through two feeders and three 3 phase transformers. Any two transformers or either feeder cable can carry the load for a short time. Looping the feeder cable through the oil switches (attached to transformers) permits disconnecting and grounding the feeder cables and interconnecting cables. The RA manually operated switch will safely break a full 400 ampere load at 15000 volts.

An economical RA load break oil switch is made to suit your distribution system plans. Consult a G&W representative about it.

VOLTAGE CHARACTERISTICS

voltage rating	60 cycle withstand dry	impulse withstand 1½ x 40 wave
7.5kv	36kv	95kv
15.0kv	50kv	110kv
23.0kv	70kv	150kv
34.5kv	95kv	200kv

CURRENT CHARACTERISTICS

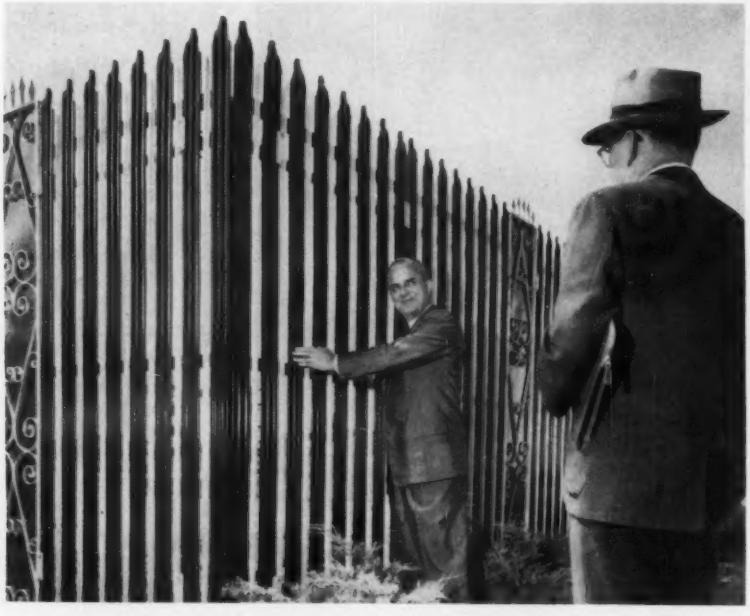
ampere rating	switch	amperes	
		momentary	4 seconds
400	standard	20,000	15,000
	special*	30,000	19,000
1000	standard	40,000	35,000
	special*	50,000	40,000

*silver inlaid contacts

G&W ELECTRIC SPECIALTY CO.
3500 WEST 127TH ST. • BLUE ISLAND, ILL.

D581

Manufacturers News



Enclosure Helps Substation Appearance

Substation enclosures don't have to look like fences, they can be designed to harmonize with neighborhood surroundings and to improve the appearance of the community. To meet this objective, Hi-Voltage Equipment Div of Joslyn Mfg & Supply Co, Cleveland, O., has designed and produced a type of enclosure that can be mounted on existing substation fences or installed in place of a fence.

An 8-ft high enclosure is shown by Joseph D. Hoffman, president of the division. He said that the cost of the enclosure, comprised of picket panels and decorative panels, is comparable to shrubbery landscaping. Other advantages are: Enclosures are difficult to climb (the Tudor design being practically unclimbable), and noise reduction is about 2.5 db.

L-Shaped Grooved Bus Developed by Alcoa

Universal angle bus conductor (UABC) is now available as a low-cost substitute for smaller sizes of tubular bus conductors, according to the Aluminum Co of America, Pittsburgh, Pa. This L-shaped bus extruded, from 2EC alloy, was developed by Alcoa to provide a conductor that will adapt to normal cable lug connectors.

On the outer surfaces of the bus, two extruded grooves locate the center points for drilling holes to attach a standard connector, or for direct connection to station apparatus. On the inner surfaces, a single groove locates the center line, so that the bus may be drilled to connect directly to insulators.

The new bus is designed primarily for use in distribution-type substations but can also be used in substations for sub-transmission voltages, and for primary distribution voltages.

Crouse-Hinds Instruments

Crouse-Hinds Instrument Co, Inc, Silver Spring, Md., is the new name of the former Surveyor Service Co, a wholly owned subsidiary of Crouse-Hinds Co, Syracuse, N. Y. Robert J. Sloan, Crouse-Hinds president, is also president of the new company. Instruments for detecting and recording weather conditions are the chief products. New products will be in the field of telemetering, supervisory control and automation.

Alumoweld Facilities to be Increased by Copperweld

An appropriation of $1,325,000 has been approved by Copperweld Steel Co to install plant facilities at Glassport, Pa., for its new Alumoweld wire and strand. "The favorable acceptance of Alumoweld has made this decision necessary," stated William W. Ege, vice president in charge of the Wire and Cable Division.

Alumoweld was started on a limited production basis a few months ago (EW, April 7, p. 96). It represents the successful application of a thick cladding of aluminum to steel. The process utilizes heat and pressure to weld the aluminum to the steel, and subsequently the bimetallic rod is drawn into wire. The new product is composed of 25% aluminum by area and reportedly retains its firm weld and one-metal quality when drawn into wire.

Advantages of Alumoweld are claimed to be good corrosion resistance, good conductivity, light weight and permanent high strength. Because of these qualities it is applicable as power conductors, overhead ground wires, core wires in ACSR conductors, and for guy and messenger strand.

Motorola Two-Way Mobile Radio Is Transistorized

The Motrac radiophone, a transistorized two-way mobile radio, has been developed by Motorola, Inc, Chicago, Ill. The radio has a completely transistorized receiver and power supply and a partially transistorized transmitter.

More than 20 transistors provide

(*Continued on page* 77)

Your Linemen will prefer

"PRESS-ON"

Faster, easier two-handed installation

1 SLIP INTO DIE with tap wire in "Press-On"
2 HOOK OVER THE RUN; no tab to bend
3 CRIMP with your present tools—Hand or Hydraulic
"PRESS-ON" CONNECTOR
Patent Pending

Complete Wrap-Around of each conductor in a solid metal wall—with a *lap joint* on the run—keeps out corrosion.

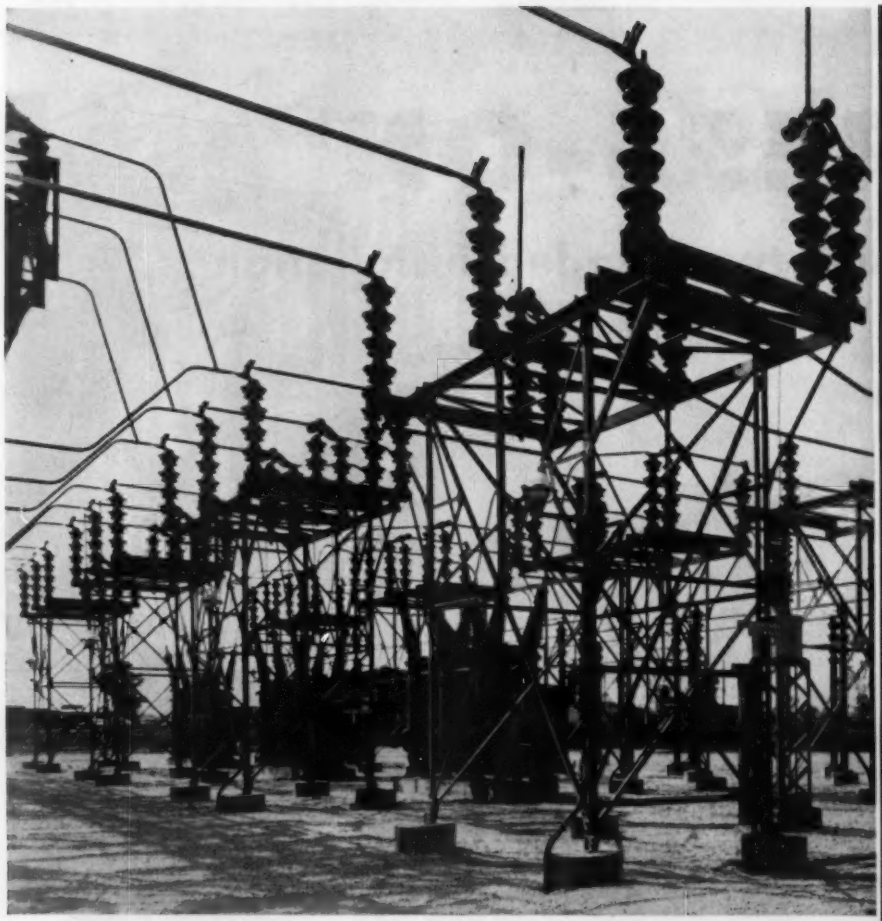
Built-in Solid Aluminum Separator prevents strand cutting; minimizes cold flow in aluminum to aluminum or corrosion in aluminum to copper.

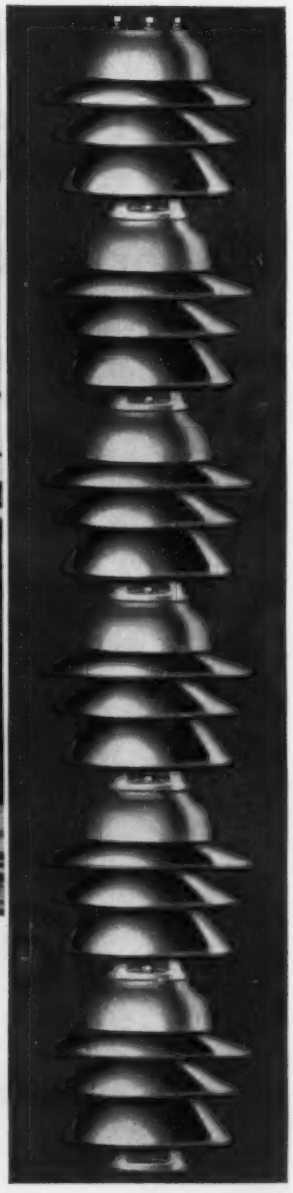
and for your Engineers .....

Made of pure aluminum, factory treated and filled with "Cual-Aid" oxide inhibitor, and individually wrapped. 23 sizes from No. 6 sol. to 4/0 ACSR. **Crimped with your present tools,** using dies and grooves you now have, or Penn-Union dies.

Write for Samples—test this faster, safer, more dependable compression tap, "Press-On." PENN-UNION ELECTRIC CORP., Erie, Pa. *30th Year of Service to the Electrical Industry.*

There's a **NEW** and **BETTER** way at **PENN-UNION**





Here's a typical stacked installation of Thomas Cap-and-Pin-type insulators, in conjunction with Delta-Star MK-40 Air Switches. They take the brunt of high-impact closing, resist all weather and atmosphere changes.

THINK *NOW* OF THE LONG HAUL... specify Thomas Cap-and-Pin Insulators

These EEI-NEMA-standard Apparatus Insulators are ready for long, hard service as bus supports and switch insulators, and for your many other BIL applications. An *extra* value is the name "Thomas", synonymous for 85 years with the highest-quality electrical porcelain.

Standard-strength Thomas insulators in all rated sizes (with 3″ and 5″ bolt circle) are completely interchangeable with any similar EEI-NEMA standard units. Thomas "QT" (Quiet-Type) underglaze treatment is available on larger sizes for suppression of corona and elimination of rf interference.

For complete information on these EEI-NEMA insulators, ask your nearest Delta-Star representative or write *Dept. 13C, Thomas Works, Delta-Star Electric Division, H. K. Porter Company, Inc., Lisbon, Ohio. District offices in principal cities.*

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Connors Steel, Delta-Star Electric, Disston, Forge & Fittings, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan-Kidd Steel, H. K. Porter Company (Canada) Ltd.

Motorola Two-Way Radio

(*Continued from page* 74)

reliability standards and current drain characteristics, according to the manufacturer. Printed circuitry, modules and die cast costruction are employed to further the units reliability, compactness and ruggedness. The entire unit is 3 in. high, 11 in. wide and 17 in. long.

The unit draws 1.82 amp while on standby. On flat terrain it reportedly will reach 40 to 50 miles.

Thorex Arrester Meets Many Distribution Needs

A new type DV-S Thorex Dynagap lightning arrester, produced by the Ohio Brass Co, Mansfield, Ohio, has design features of two other distribution types for its adaptation to many distribution requirements. This arrester is equipped with automatic ground lead isolator, plus a stud connection for the line terminal. The primary air gap is contained within the porcelain housing.

A heat-sensitive explosive rivet in the terminal assembly isolates the ground lead. On detonation, this fractures a plastic support, dropping the ground clear, and permitting operation of the line in the event of arrester failure. The isolator has no effect on normal arrester operation, functioning only in emergencies.

U. S.-Europe Submarine Cable to be Laid in 1959

Installation of the first submarine telephone cable system that will link North America directly with the mainland of Europe has started. Shore operations off Clarenville, Newfoundland, and Penmarch, France are nearing completion, according to American Telephone & Telegraph Co, New York.

The 2,400-mi deep sea portion of the cable system will be laid next summer and the cables will go into service later in 1959. At least 36 voice circuits will be provided between the United States, France, Germany, and other European nations.

For this $40 million project, the

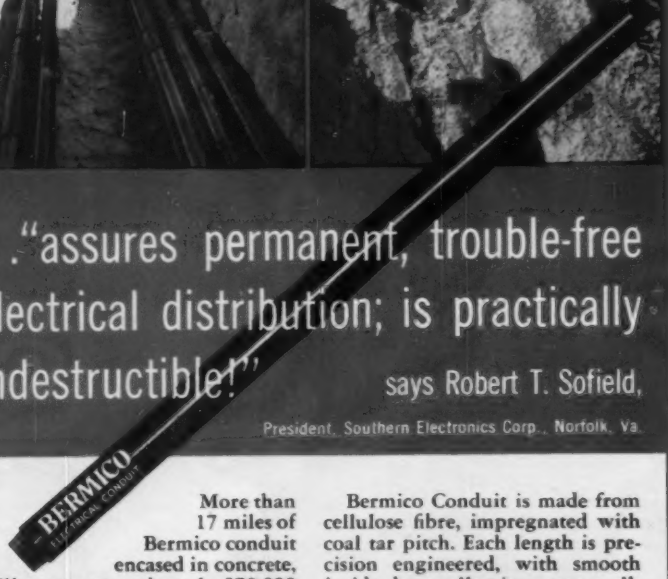
(*Continued on page* 78)

BERMICO® electrical conduit used at Bomarc Missile Base

...“assures permanent, trouble-free electrical distribution; is practically indestructible!”

says Robert T. Sofield,

President, Southern Electronics Corp., Norfolk, Va.



More than 17 miles of Bermico conduit encased in concrete, will carry approximately 270,000 feet of power and communication lines in the underground electrical distribution system at this new Missile Launching Base at Fort Dix, N. J.

“Because Bermico can be handled so easily it enables a small crew to install it fast,” added Mr. Sofield. “On an installed basis, steel would cost about 3 times more.”

Bermico Conduit is made from cellulose fibre, impregnated with coal tar pitch. Each length is precision engineered, with smooth inside bore allowing easy pull-through without abrasion. Highly resistant to acids, alkalies, heat, water and corrosion. Widely used by leading contractors on this and other government projects because it surpasses Federal Specification W-C-581 by a generous margin.

Specify Bermico for your next job. Immediate shipment of all sizes and fittings guaranteed.

Distributed by WESTINGHOUSE Electric Supply Company

Offices in principal cities

BROWN COMPANY

General Sales Offices: 150 Causeway Street, Boston 14, Mass.
Mills: Berlin, N. H.; Corvallis, Ore.

have your

Westinghouse representative

tell you how you can

CHANGE OUT A

DISTRIBUTION

TRANSFORMER

AT THE BREAK-EVEN POINT

Now—an indication to show when the loading on a pole-type distribution transformer has reached economical change-out point on conventional or protected units . . . Another answer to meet a changing need—made possible because Plowback of earnings into research maintains Westinghouse leadership in distribution transformer development.

J-70847

YOU CAN BE SURE...IF IT'S

Westinghouse

Submarine Cable

deep-sea cable is being made by Simplex Wire & Cable Co, Newington, N. H. and other manufacturers in France, Germany and England. The 116-amplifiers are being produced by Western Electric Co at Hillside, N. J.

Plant Foundations Built On Compacted Sand

A 33,000-kw generating plant of the Cornbelt Power Cooperative, Spencer, Iowa, will have foundations built on sand compacted by Vibroflotation. The compaction service is being performed by the Vibroflotation Foundation Co, a subsidiary of the Rust Engineering Co, Pittsburgh, Pa.

This process is the compaction resulting from the simultaneous vibration and saturation of a granular soil by a Vibroflot machine, a 6 ft by 15 in. tubular instrument which develops a 10-ton centrifugal force. Compaction is achieved by removing the voids between particles through rearranging the grains of sand into a tight mass. This produces a firm foundation. It reportedly eliminates the need for piling.

IEC, ASTM Insulation Test Standards Available

An international standards recommendation covering electrical insulating materials is obtainable through the American Standards Association, 70 E. 45th St, New York.

The recommendation is in the Interntional Electrochemical Commission publication No. 93, Recommended Methods of Test for Volume and Surface Resistivities of Electrical Insulating Materials. Price, $2.40.

Three ASTM revised specifications covering insulating materials have been approved by ASA. They are: ASTM Designation D348-56, ASA C59.14-1958, Standard Methods of Testing Laminated Tubes Used for Electrical Insulation; ASTM Designation D349-56, ASA C59.14-1958, Standard Methods of Testing Laminated Round Rods Used for Electrical Insulation; and

ASTM Designation D923-56, ASA C59.21-1958 Standard Method for Sampling Electrical Insulating Oils. Price, $0.30 per copy.

Highway Trailer Overhauls Line of Earth Borers

Highway Trailer Co, Edgerton, Wis., has overhauled its earth-boring machines. Some old models have been made obsolete and new features added to the line. Two improvements are—increasing by ¼ in. the diameter of shifter shaft, and providing an additional 33⅓% more clutch, enabling the company to offer integral winches on all models of its machines.

The company is reported planning to open a $1.25 million plant in Hazelton, Pa. Construction of the 41,000 sq ft building by the city's development organization is expected by early January.

Terminal Epoxy Insulated

A Minnesota Mining & Manufacturing Co method making shielded, high voltage terminals insulated with epoxy resins has effected time savings of 50% over conventional methods, according to the manufacturer. The new method, part of the "Scotchcast" brand resin pressure splice system, uses pre-designed terminal shields of heavy plastic slipped over a plastic tube closed with a stepped end cap to fit various cable sizes. Each terminal shield is rated at 5 kv and may be used in combination up to 15 kv.

MANUFACTURERS BRIEFS

Cottrell Paper Co, Fall River, Mass., is again making available Coparex a 100% rag electrical insulating paper, as a supplement to its Class A Copaco and Class B Copalam lines.

United States Steel Corp, Pittsburgh, Pa., will produce aluminum coated steel sheets, following a facility modification program at the company's Irvin Works near Dravosburg, Pa. The modified coating line will produce sheets 18 gage and lighter. The products will combine the inherent strength of carbon steel with aluminum's resistance to atmospheric corrosion, good heat reflectivity and heat resistance.

Remington Rand Ltd, Toronto, Canada, (subsidiary of Sperry Rand Corp, U.S.A.) has delivered the first Univac II electronic computer to be installed in Canada to the Hydro-Electric Power Commission, Ontario. The Univac system will be the center of a network linking the Commission's nine regional offices and 105 rural operating area offices through teletype communication within a 250,000 sq mi operational area. Handling of customer data will begin this fall. The entire network will be completed next spring.

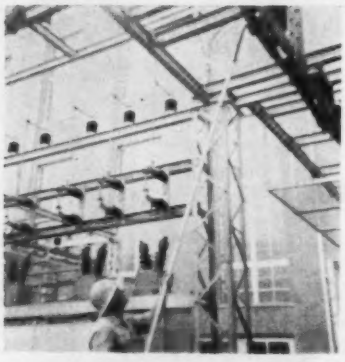
I-T-E Circuit Breaker Co, Philadelphia, Pa., has reportedly developed the first metal-enclosed six-pole anode circuit breaker to permit drawout of individual poles without interruption of process power. The single-pole drawout, providing continued supply of d-c power while one phase is being serviced, will eliminate costly downtime on aluminum reduction and other electrochemical production processes, according to I-T-E. This high-speed anode breaker is used for fault protection of mercury arc rectifiers.

Olin Mathieson Chemical Corp, New York, two French companies, a Swiss company, and a British company have formed a $135 million corporation, "FRIA" to develop bauxite deposits and to produce alumina in French Guinea.

Babcock & Wilcox Co, New York, recently exported a 325,000-lb boiler drum to Tohoko Electric Power Co, Japan. This drum with an over-all length of 67 ft 8 in. and about 8 ft in diameter will be used in a boiler for a steam capacity of 1,300,000 lb per hr.

Murray Manufacturing Corp, Brooklyn, N. Y., offers eight-week delivery on cast-in concrete reactors. Improved facilities, plus a reduced backlog, make this possible. Reactors are engineered to specifications for indoor and outdoor service; and are available for general and special purpose use.

New Equipment



Fiber Glass Hotstick . . .

. . . has longitudinal lay-up of glass fibers to provide additional strength. Core is cellular acetate. Stick has no water absorption and has dielectric wet strength of 150 kv per ft. Cast aluminum-titanium heads and fittings are securely bonded to pole. Longitudinal lay-up prevents splintering or snapping of pole. Stick is available with O.D. from 1⅛ to 2 in. It is available in single poles up to 20 ft and sectional poles up to 14 ft.

Engineering Enterprises, Inc. P.O. Box 2721, Charlotte, N. C.

Neutral Compression Splice

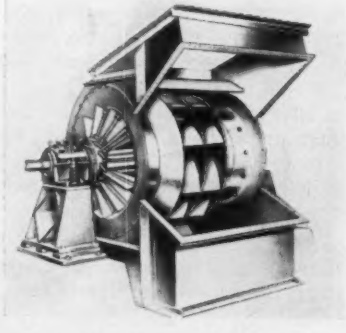
. . . can be used for short span ACSR and all-aluminum messenger neutrals, as well as service entrance triplex. Available in ½ and ⅝-in. O.D. these sleeves are designed for combinations of No. 6 stranded to No. 1/0 stranded. Holding power exceeds 50% of ACSR rated ultimate and 80% stranded aluminum rated ultimate. Solid center stop assures proper cable insertion depth and distribution of inhibitor. Both sleeves are filled with inhibitor and capped with easily punctured plastic caps.

Anderson Electric Corp, Birmingham 1, Ala.

Rapper Control System . . .

. . . for Cottrell precipitators permits simple adjustment of rapping frequency, rapping intensity, and rapping pattern. Rapping frequency is adjustable from 50 seconds to 3½ hr. Number of impacts may be 2, 4, or 8 per cycle. When variable cycle is used, first blow is soft, to remove only heaviest accumulation. Successive blows become increasingly harder. This Full-Range unit operates at low voltage to make servicing and testing simpler and safer. Timing circuit is made up of passive electronic controls, with no motors, gears or other components which require frequent maintenance.

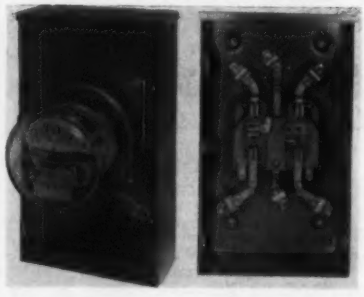
Western Precipitation Corp, 1000 W Ninth St, Los Angeles 54, Cal.



Heavy Duty Fans . . .

. . . for mechanical draft and similar applications may be used as forced draft fans for combustion air supply with open inlets; with inlet boxes to handle pre-heated air, industrial process supply and exhaust applications; and as induced draft fans for oil or gas firing applications. These Series 4000 Airfoil fans are available in 15 sizes with capacities from 10,000 to 700,000 cfm and pressure up to 45 inches of water. Operating temperature range is from —20 F to 850 F. Mechanical efficiency is better than 90%. Design provides quieter performance. These fans are available for direct connection to a-c motors or turbines.

Westinghouse Sturtevant Div, Dept T-234, 200 Readville St, Hyde Park, Boston 36, Mass.



Socket Meter Mounting . . .

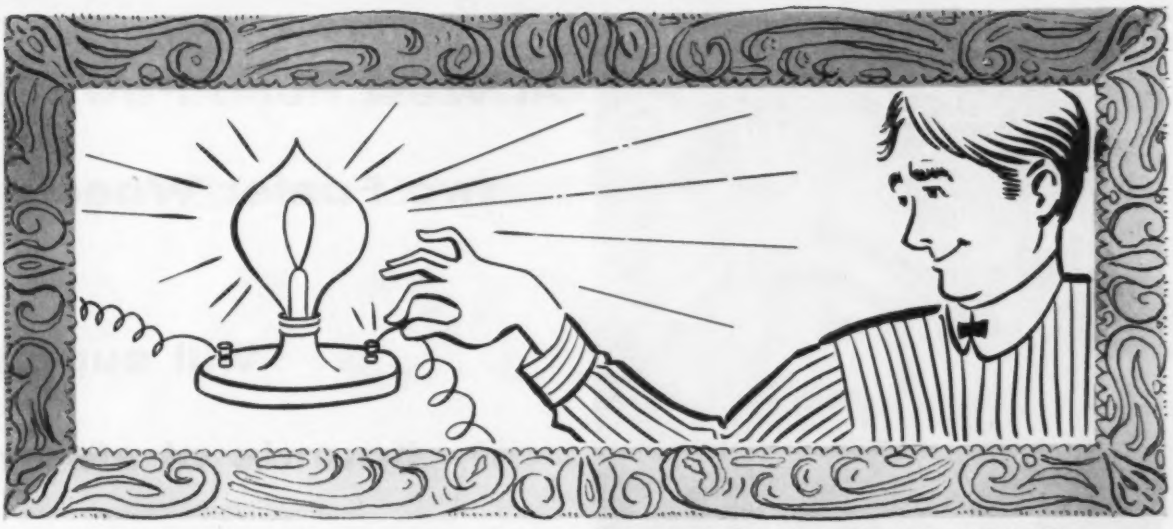
. . . for 200-amp meters has provision for manual by-pass when meter is replaced or tested. This feature prevents interruption of current to electric clocks and other customer loads which need continuous supply. Split cover design permits conventional meter mounting and sealing and makes terminals readily accessible for bypass link. Bottom of cover can not be replaced while bypass links are on bus bars. Total current carrying capacity of jaws and the beryllium copper springs which hold them against the meter terminals is over 225 amp. Terminals will accept No. 12 to 4/0 wire. Mounting design permits free air circulation around porcelain block and minimizes chance of ground or short. Fifth or sixth terminal may be added from front of mounting.

Code Equipment Sales Co, 222 Kalos St, Philadelphia 28, Pa.

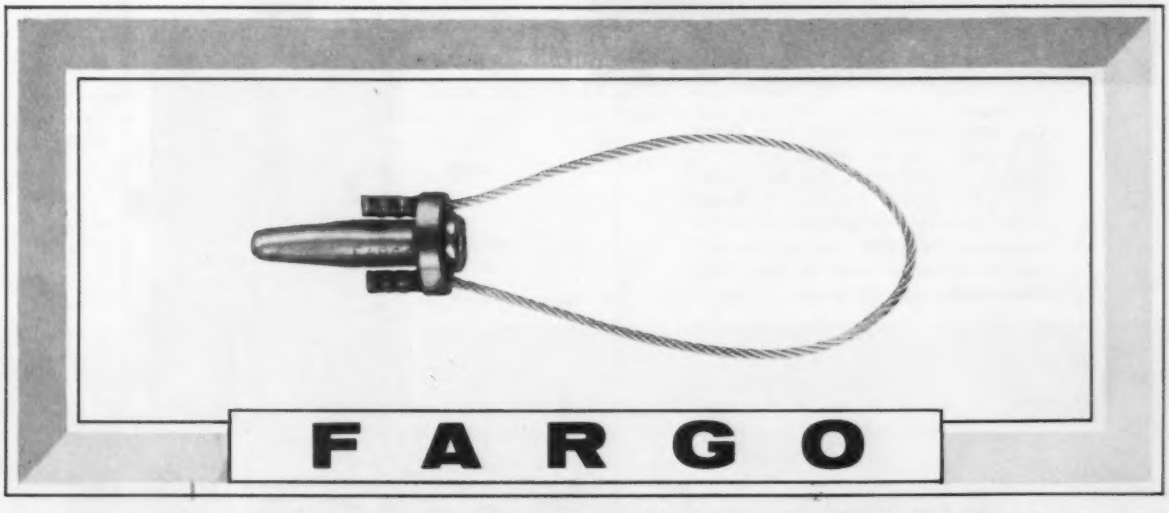
Pole Hole Digger . . .

. . . for use with Chevrolet 4-wheel drive trucks is completely self-powered and does not require expensive power take-off equipment. Truck need only be equipped with

(*Continued on page* 84)



FAMOUS CONNECTIONS
that last and last...



"Automatic" DEAD ENDS

Fargo "automatic" dead ends, also, make a connection that last and last.

Fargo "automatics" all have the exclusive one piece jaw that is precision machined from rod stock. The four segments of the one piece jaw are always in perfect alignment and move as one integral unit adjusting to the contour of the conductor or messenger. A smooth internal sleeve allows easy insertion of the stranded conductor.

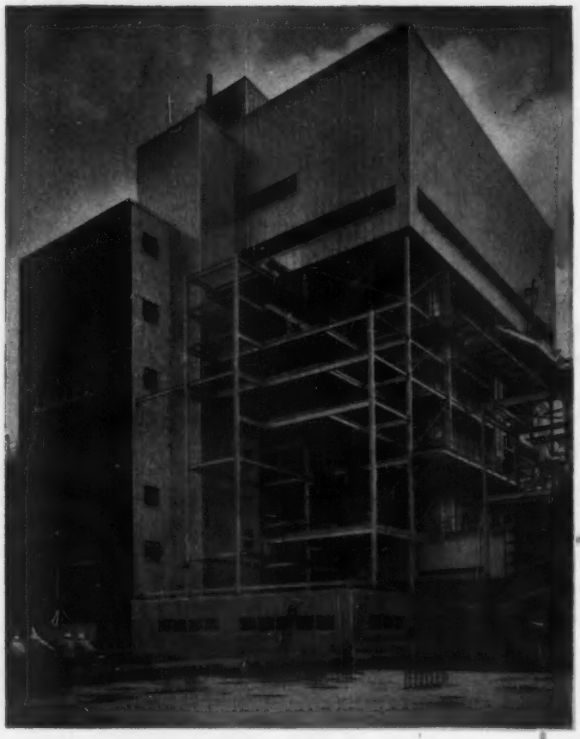
In addition to flexible bail dead ends, (above) Fargo manufactures solid bail, double bail, detachable bail, and covered bail dead ends for copper, aluminum, aluminum alloy, and Copperweld cable.

The Fargo "automatic" dead ends are durable, dependable, and make connections that last and last.

Ask your Line Material Field Engineer for complete details.

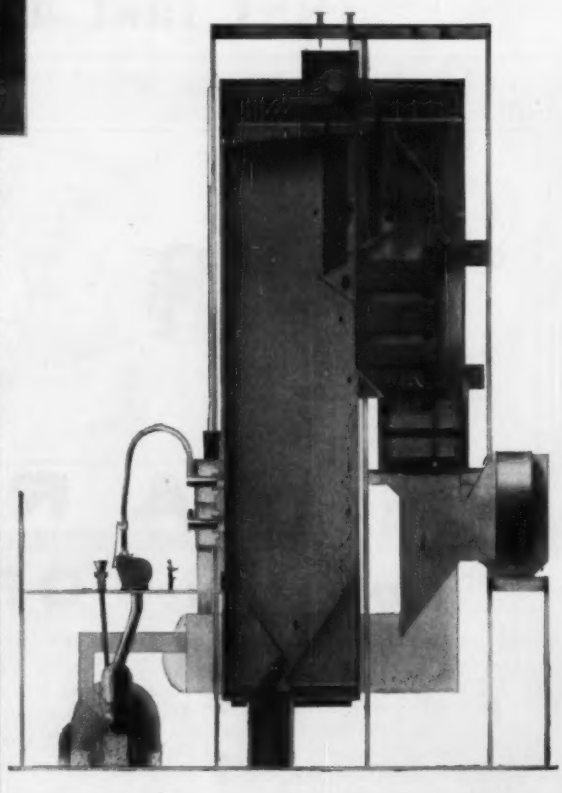
Distributed by
LINE MATERIAL INDUSTRIES
McGraw-Edison Company
Milwaukee, Wisconsin
In Canada, CANADIAN LINE MATERIALS, LTD., Toronto, Canada

Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie
New York



At West Penn Power's two Foster Wheeler will supply pounds of steam

Completed portion of West Penn Power Company's new Armstrong Generating Station, shortly before Unit No. 1 went on line this Spring. Unit No. 2 is already under construction and scheduled for completion in 1959. This is the third new power station built by West Penn Power in the past 10 years.



Cross sectional view of one of the two Foster Wheeler reheat steam generators for Armstrong Station. Each unit has a normal capacity of 1,200,000 lb of steam per hour at 1875 psig and 1010 F, with reheat to 1010 F.

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

NEW ARMSTRONG STATION

Reheat Steam Generators

2,400,000

per hour for Units No.1 and No.2

MORE POWER for Western Pennsylvania—165,000 kw now on line and *another* 165,000 kw next year. This is the increased capacity which is being made available by West Penn Power Company's new Armstrong Generating Station on the Allegheny River north of Kittanning. Unit No. 1 is now completed and in operation, and construction for No. 2 is well under way. When completed, this station will be the second largest of West Penn's seven generating stations and will supply enough power to serve several cities of 100,000 people — and will bring the Company's total generating capability to approximately 1¼ million kilowatts.

The two turbo-generators for Armstrong Station, Units No. 1 and No. 2, will be served by two identical Foster Wheeler reheat steam generators, each with a normal capacity of 1,200,000 pounds of steam per hour at 1875 psig and 1010 F at the superheater outlet, with reheat to 1010 F. Each unit will be equipped with two FW Ball Mill Pulverizers and FW Intervane Burners.

This new installation is another example of the confidence placed in Foster Wheeler by leading central station and industrial power companies — confidence that is based on Foster Wheeler's more than 50 years of specialized engineering, fabrication and construction experience in the steam generation field. For equipment to meet your specific requirements, write to *Foster Wheeler Corporation, 666 Fifth Avenue, New York 19, N. Y.*

Firing front of Foster Wheeler reheat steam generator for Armstrong Station Unit No. 1, showing feeders, exhausters and burners.

What a line...

CF&I GALVANIZED STEEL STRAND

Where overhead distribution lines must cover long spans, or in areas where high velocity winds and adverse weather impose a severe strain on power poles, dependable guying is a must.

To provide safe installation and long, trouble-free service life, ground crews prefer CF&I Galvanized Steel Strand. It is made of steel with exactly the right chemical and physical properties to assure high strength and easy workability. The wire is carefully drawn, stranded, cleaned and galvanized with a tightly-bonded coat of pure zinc to produce a corrosion-resistant finish that won't flake, even when severely bent.

CF&I Galvanized Steel Strand meets or exceeds ASTM Specification A-122 or A-363, and is made in a seven- or three-wire construction to meet your specifications. Your nearby CF&I representative or local electrical distributor can give you complete details. Call him today.

CF&I GALVANIZED STEEL STRAND
THE COLORADO FUEL AND IRON CORPORATION

THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise • Butte • Denver
El Paso • Ft. Worth • Houston • Kansas City • Lincoln • Oklahoma City • Phoenix • Pueblo • Salt Lake City • Wichita
PACIFIC COAST DIVISION—Los Angeles • Oakland • Portland • San Francisco • San Leandro • Seattle • Spokane
WICKWIRE SPENCER STEEL DIVISION—Atlanta • Boston • Buffalo • Chicago • Detroit • New Orleans • New York • Philadelphia
CF&I OFFICES IN CANADA: Montreal • Toronto • CANADIAN REPRESENTATIVES AT: Calgary • Edmonton
Vancouver • Winnipeg 5904-A

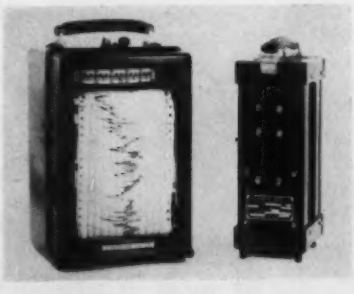
Pole Hole Digger . . .

(*Continued from page* 80)

winch and boom at either front or rear. Digger has interchangeable augers from 6 to 24 inches and is equipped with 9.2-hp gas engine. Standard digging depth is 6 ft; extensions increase depth to 25 ft. A variety of heads is available.
Roper Mfg Co, 7th & Elm St, Zanesville, Ohio

Ring-Type CT . . .

. . . is easily installed on small switchboards and portable a-c meters. Unit can be slipped over primary conductor and taped in position for permanent installation. Insulation is 4.5 kvac. Standard leads are 24 in. long, but lengths up to 48 in. can be supplied. Lengths shorter than 24 in. are also available. No primary is supplied.
Midwest Electric Products, Inc, Dept R, Mankato, Minn.



Portable Step-Up PT . . .

. . . provides low a-c voltage ranges for the manufacturer's rectifier type ac-dc volt-ammeter. Transformer

(*Continued on page* 86)

RT&E

Concentration on distribution transformers only has led RT&E to superior engineering achievement in every phase of transformer development.

One outstanding example of such achievement is clearly evident in R T & E transformer insulation. Because insulation is so important in over-all transformer performance, R T & E impulse withstand levels exceed NEMA requirements by as much as 50%. In addition, R T & E transformers can be safely overloaded without exceeding NEMA temperature rise limitations.

engineering talent concentrated on transformer

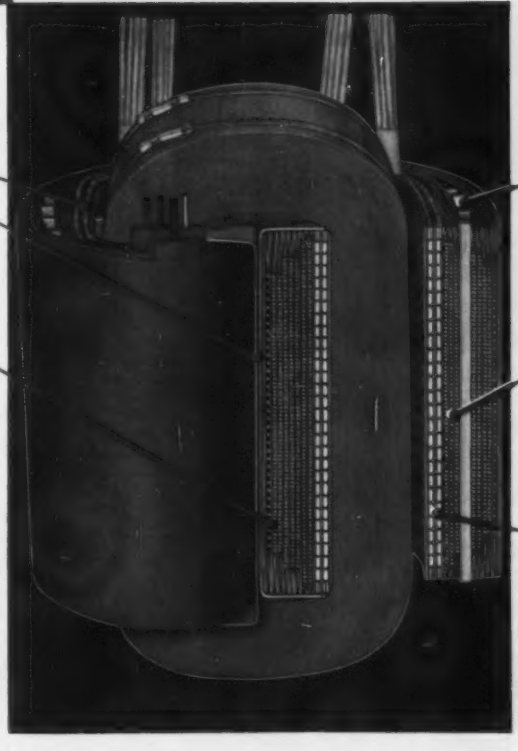
insulation

assures higher overload capacity, extra surge strength

COIL LAYER INSULATION
A minimum of two sheets per layer of high grade 100% pure Kraft electrical paper is used. Thickness choice is such that a maximum stress of 30 volts per mil thickness is attained at high stress points. Major insulation is used as a barrier between primary and secondary windings. Heavy transformer board is used as a barrier between secondary windings and the core.

SURGE PROTECTION
All coils are protected against lightning and switching surges. This is accomplished by means of a space wound layer which resists turn to turn failures and by stepping back the end turns of coil layers and locking them in place with folded paper insulation. This provides a high factor of safety in creepage distances and offers a high resistance to winding to ground or secondary lightning punctures.

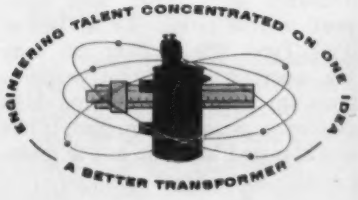
VARNISH
To further enhance the mechanical and electrical strength of the coil, it is immersed in a high solids, high mechanical strength thermosetting varnish that will not soften, dissolve, or affect the cooling oil. After thorough penetration by this varnish, the coils are baked to assure complete curing of varnish and to remove moisture. Final coil drying is done under heat and vacuum in the transformer tank before the oil is added.



INHIBITED OIL
The finest mineral oil, inhibited with DBPC, is used in all R T & E transformers, but only after it has gone through a special drying and filtering process to maintain a dielectric strength of at least 30,000 volts breakdown when tested according to ASTM standards.

TURNS INSULATION
Primary (high voltage) turns are round-wire, insulated with heavy Formvar which has excellent electrical properties, resistance to bending abrasion and heat, and is chemically stable.

Secondary (low voltage) turns use rectangular or square conductors, and are either double cotton or ¾ lap paper insulated. This insulation has excellent varnish absorption qualities which enhance the mechanical and insulating qualities of the coil.

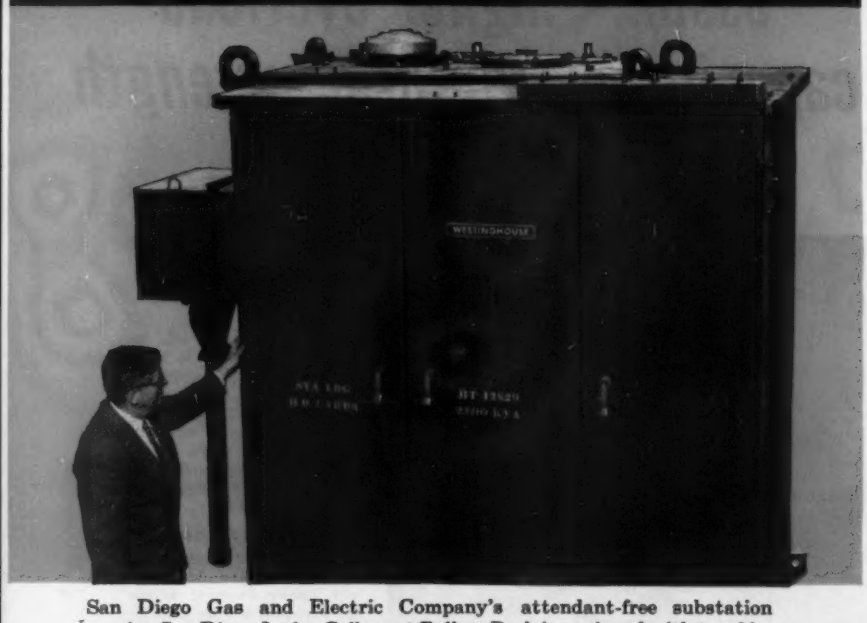


RT&E CORPORATION

WAUKESHA, WISCONSIN • PORTLAND, OREGON

Ask your Westinghouse representative
about the exclusive benefits you get from

CONTACT-FREE
MAGAMP CONTROL WITH
MAINTENANCE-MISER DESIGN . . .
BASIC FEATURE FOR
ATTENDANT-FREE SUBSTATIONS



San Diego Gas and Electric Company's attendant-free substation serving San Diego Junior College at Balboa Park is equipped with trouble-free Westinghouse Magamp control.

Attendant-free substations demand maintenance-free components. When Westinghouse load tap changers are used on a CSP® power transformer, load tap changing substations transformer or station-type voltage regulator, there too is found the contact-free Magamp* control.
Magamp control, with Maintenance-Miser design for both the primary relay and time-delay relay, assures you of the economic advantages of trouble-free service from your attendant-free substations. Here's why:

- No moving parts to clean and adjust.
- No contact to check and burnish.
- Relays never need to be rebalanced.
- "Set-and-forget" control never needs adjustment.

Call your Westinghouse representative for the complete story of how you can improve your power distribution economics with attendant-free substations equipped with Magamp control . . . another example of how PLOWBACK OF EARNINGS into research and development is helping you meet the increasing problems created by America's electrical growth.

*Trade-Mark J-70874

YOU CAN BE SURE...IF IT'S Westinghouse

Portable Step-Up PT . . .

(*Continued on page* 86)

has primary ranges of 5, 15, and 30 v to 150-v, 60-cps secondary. Intermediate ranges above 30 v can be handled by taps on recorder between 0-50 and 0-150 v. Unit is compensated for 7.5 va. Dielectric test is 2.5 kv, 60 cps, for one minute. Unit weighs 9.5 lb.
Esterline-Angus Co, Inc, Box 596, Indianapolis 6, Ind.

Pipe-Mounting Wireholder

. . . for service entrance masts fits all pipes from 1¼ to 2½ in. This No. 652001 wireholder has large copper-bail reinforced insulator with extra large wire hole. Mounting bolts are swedged to bracket for ease in handling. Unit may be installed without removing nuts or washers. All steel parts are galvanized heavy gauge. Back bar design obviates reversing on small pipes but provides sturdy tight fit on all size masts.
Porcelain Products, Inc, Carey, Ohio

Silicon Rectifier . . .

. . . has 160-amp average forward current in single-phase circuits and 150-amp in 3-phase, with max. peak inverse ratings up to 500 v. This Type 329 rectifier has long life, operates at junction temperatures up to 190 C and has high efficiency. Small and rugged, it has nickel-plated hermetic cell to main-

tain low resistance and prevent corrosion. It is available in all types of bridge assemblies for either forced air or natural convection cooling.
Westinghouse Electric Corp, P.O. Box 2099, Pittsburgh 30, Pa.

Electronic pH Meter . . .

. . . for boiler condensates and feed water has wide range and high sensitivity. Three minutes after being plugged into 100-125-v, 50-60-cps a-c circuit, it is ready for operation. Readings are not affected by color, turbidity, or chlorine in test sample. Auxiliary pointer permits check of standardization without need for buffer solutions between measurements.
Hagan Chemicals & Controls, Inc, P.O. Box 1346, Pittsburgh 30, Pa.

Trencher Attachment . . .

. . . digs up to 600 to 800 ft per hr. It compensates automatically for varying ground conditions, and handles trenches up to 6-ft deep in 6-, 8-, 10-, 12-, and 14-in. widths. Designed to be used with the Work Bull industrial tractor, this Auburn Gear-Draulic Trencher can dig straight down from starting position and back-trench under obstructions. Hydraulic digging boom has vertical operating arc in excess of 190 deg. All operations are controlled from the driver's seat.
Massey-Ferguson Industrial Div, 1009 S. West St, Wichita, Kansas

Cable Cart . . .

. . . transports, cuts, measures, and coils wire and cable. One man can easily move the Cablecart about a shop. A five-digit measuring meter has 2.5-inch O.D. capacity (up to 750 Mcm). The all-position 5-ton hydraulic cutter has 3.5 in. O.D. capacity. Sprocket gear and chain drive operate the two-piece pay-out, take-up reel. Cart is 5 ft long, 42 inches high, and 27 inches wide.
Suttle Equipment Corp, 135 LaSalle St, Chicago 3, Ill.

Gasoline Generator . . .

. . . rated 125 kw, 1800 rpm is adaptable for emergency standby service. Offered in single- and 3-phase models, with latest control and panel equipment, it is revolving field type, external regulated, single bearing design, with amortisseur windings and direct connected exciter, directly fastened on steel bedplate. Six-cylinder, 4-cycle engine has 935 cu in. displacement. Coupling is semi-flexible. Engine is also available with natural gas and propane carburetor.
Katolight Corp, First Ave & Chestnut St, Mankato, Minn.

More New Products

Diagonal bladed **weed chopper and stalk cutter** has combined hacking and slicing action. Slice-O-Lator weighs 1,600 lbs with drums empty, 2,500 filled; has six-ft cutting width; can be pulled by 20 hp on drawbar under normal conditions.—M&W Iron Works, Box 309, Deerfield Beach, Fla.

Phase sequence indicator determines the sequence of voltage peaks in a multiphase supply. Model VA2 is a light, compact instrument designed for direct connection to voltage between 104 and 480 v. Frequency range from 30 to 1,000 cycles.—Opad Electric Co, 69 Murray St, New York 7. N. Y.

Series 7000 high-voltage a-c **power supplies** are available in 19 models for 220- or 440-v, 60-cycle, 1-phase inputs, with output from 0-25 to 0-150 kv, at 5 to 100 kva. Units are used for dielectric testing and have adjustable automatic rate of rise. Dual-range kilovoltmeter and milliameter have ± 5% full-scale accuracy—Beta Electric, Richards Ave, S. Norwalk, Conn.

MAGAMP CONTROL . . . PREFERRED BECAUSE:

Mr. C. D. Mack, Electrical Maintenance Supervisor, San Diego Gas and Electric Company, sets control of attendant-free substation serving San Diego Junior College.

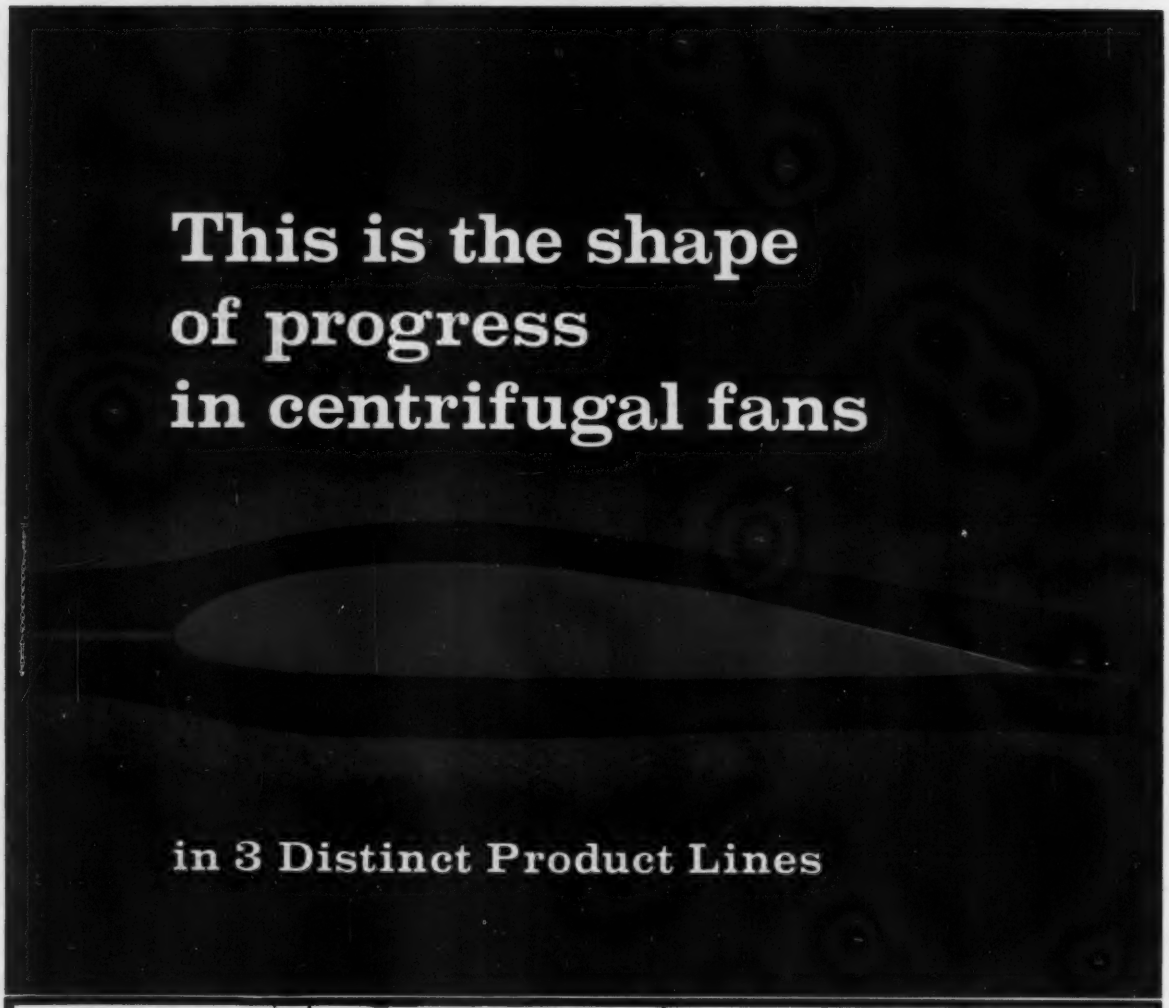
Here are the "plus" features that have made Magamp* control the preferred control:

- Completely static — no moving parts in either sensing or timing devices.
- Complete stability after setting.
- All control setting is electrical.
- ASA Class I accuracy.

. . . And only Westinghouse load tap changers have Magamp control. J-70875

*Trade-Mark

YOU CAN BE SURE...IF IT'S Westinghouse



FULL RANGE APPLICATION	COMBUSTION AIR FOR CONVENTIONAL BOILERS Series 4000	HIGH PRESSURE AIR FOR PRESSURIZED FURNACE BOILERS Series 2200	PRIMARY AIR Series 2100
Volumes (cfm)	10,000 to 700,000	25,000 to 350,000	6,000 to 50,000
Pressures ("H_2O)	Up to 45"	45" to 90"	Up to 65"

Westinghouse Airfoil* blading offers . . .

Lowest Operating Cost
Highest mechanical efficiency ever: over 92%.

Quieter Operation
Perceptibly quieter in actual operation.

Stable Pressure
Ideally suited to single and parallel operation.

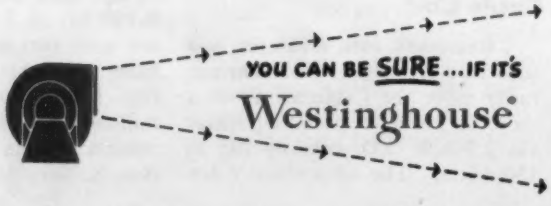
Non-Overloading Power Feature
True self-limiting horsepower characteristic.

Optimum Performance
Sized for specific customer requirements.

Inlet Air Spin Control
Efficient at part loads. Saves power, saves dollars.

Call your nearest Sturtevant Division Sales Engineer, or write Westinghouse Electric Corporation, Dept. H-18, Hyde Park, Boston 36, Massachusetts.

*Trade-Mark J-80669



NEW LITERATURE

• **FLOODLIGHTING:** 8-p bulletin 2701 highlights advantages of floodlighting for football and gives tips on installation and maintenance. Crouse-Hinds Co, Syracuse 1, N. Y.

• **GROUNDLINE DECAY:** 14-p booklet covers three basic objectives to be achieved through a pole inspection program. Utilities Div, Osmose Wood Preserving Co of America, 980 Ellicott St, Buffalo, N. Y.

• **SOLENOID VALVES:** 8-p stock list #505 contains prices, valve ratings, flow diagrams, illustrations and engineering data on solenoid valves. Automatic Switch Co, Hanover Rd, Florham Park, N. J.

• **LIGHTING:** Three booklets describe various aspects of commercial, industrial, and residential lighting. DR-358-25 discusses reflector lamps, DR-1257-25 is an incandescent lighting guide book, and DR-1257-15 tells the story of infrared lamps. Sylvania Lighting Products, 60 Boston St, Salem, Mass.

• **MOTOR CONTROL CENTERS:** Data book has compilation of all technical data required to engineer and specify motor control centers. Northeastern Engineering Inc, 25 S. Bedford St, Manchester, N. H.

• **VOLTAGE REGULATORS:** Electro Mechanical Transistorized automatic voltage regulators are described in 12-p bulletin S358EMT. Ratings listed are from 2 to 100 kva for 115,230 or 460 v, 50/60 cycle, single of three phase service. The Superior Electric Co, Dept EMTB, Bristol, Conn.

• **ALUMINUM ALLOY CONDUCTORS:** Complete commercial availabilities of All Aluminum Alloy Conductor (AAAC) for distribution systems are listed in 9-p brochure, EC 718. Charts on solid and stranded AAAC availabilities in AWG sizes from #6 up are included. Kaiser Aluminum & Chemical Sales Inc, Dept. NR-12, 919 N. Michigan Ave, Chicago 11, Ill.

• **POTHEADS:** 8-p catalogue tells of drawn steel potheads to 15 kv with ¼ in. steel plate body. ESCO Manufacturing Co, Box 1039, Greenville, Texas.

• **INTEGRAL MOTORS:** Complete selection data on single and polyphase integral hp induction motors up to 20 hp are included in Bulletin 104. R. A. Young, Leland Electric Co, Box 1060, Dayton 1, Ohio.

• **CABLES:** 14-p booklet, 682-2-58, has been compiled to help electrical engineers prepare specifications for special electric cable installations. National Electric Products Corp, 2 Gateway Center, Pittsburgh 22, Pa.

• **LIGHTING:** "Service Station Lighting and Wiring" is a 24-p bulletin listing Conduets and floodlights with recommendations for electrical installations. Crouse-Hinds, Syracuse 1, N. Y.

• **COMPANY BOOKLET:** 12-p booklet illustrates line of low-voltage switchgears, explosion-proof equipment, high-voltage motor starters, motor control centers, and certain specialized products. Nelson Electric Co, Tulsa, Okla.

• **DOW CORNING PUBLICATIONS:** Silicone insulating systems, both resinous and rubber-like, are described in 8-p brochure, 10-106. Working case histories are detailed and illustrated. Information on the properties of a modified silicone magnet wire coating is contained in 4-p brochure, 10-404. Includes tables and charts based on laboratory and field experience data. Brochure 10-109 has selection guide to silicone insulating components and another to materials and components for insulation systems of different temperature classes. Dow Corning Corp, Midland, Mich.

• **STORAGE BATTERIES:** Technical manual, 210, 24 pp, on use of stationary storage batteries has reports on engineering studies on the effect of temperatures on battery capacity and provides tabulated data and general information. Exide Industrial Div, Electric Storage Battery Co, Box 8109, Philadelphia, 1, Pa.

• **SERVICES:** 12-p brochure describes services company can provide. Hathaway Instrument Div, Hamilton Watch Co, Denver, Colo.

• **PANCAKE MOTORS:** Engineering information on flange type pancake motors and motor features is presented in 4-p bulletin, No. 2100. The Louis Allis Co, 427 E. Stewart St, Milwaukee 1, Wis.

• **HOT LINE TOOLS:** Catalog 58 has complete descriptions and prices of catalogued hot line tools. Bodendieck Tool Co, Rt 48 North, Taylorville, Ill.

• **ULTRASONIC CLEANING:** 24-p fact book, S-200 explains practical applications and basic principles of ultrasonic cleaning. Branson Ultrasonic Corp, 40 Brown House Rd. Stamford, Conn.

• **VOLT-AMMETER-OHMETER:** Bulletin A-583 with complete information on the Amprobe line gives model numbers, specifications, applications and price lists. Pyramid Instrument Corp, Amprobe Div, 630 Merrick Rd, Lynbrook, N. Y.

Westinghouse airfoil fans serve these leading utilities

COMBUSTION AIR FOR CONVENTIONAL BOILERS

Consolidated Edison
Ohio Valley Electric Corp.
Duke Power Co.
Duquesne Light Co.
Pennsylvania Electric Corp.
Tennessee Valley Authority
Philadelphia Electric Co.
Commonwealth Edison
Dayton Power & Light
Cleveland Electric Illuminating Co.

HIGH-PRESSURE AIR FOR PRESSURIZED FURNACE BOILERS

Ohio Power Co.
United Illuminating Co.
Detroit Edison Co.
Appalachian Electric & Power Co.
Indiana & Michigan Electric Co.
Atlantic City Electric Co.
Missouri Public Service
Memphis Light & Power Co.

PRIMARY AIR

Detroit Edison
Consolidated Edison
Toledo Edison
Ohio Power Co.
New England Power
Virginia Electric & Power
Delaware Power & Light
Public Service Electric & Gas

J-80675

Union Electric's Commercial Cooking Campaign

. . . racks up 807 kw selling 119 electric deep fat fryers and an additional 775 kw with other cooking equipment

A 13-week electric commercial deep fat fryer promotion added 807 kw through the sale of 119 electric fryers—43 replaced existing gas fryers—for the Union Electric Co. In addition, 775 kw of cooking equipment other than fryers was added, for a 1,582 kw total. E.A.R. is $47,460.

Campaign objectives were:

1. To sell electric fryers.
2. Use the fryer as an opening wedge in selling the food service operator on the use of other electric cooking equipment.
3. To improve the utility relationship with dealer salesmen of the electric commercial cooking equipment supply company.

Three demonstrations conducted by the utility personnel were held in the showroom of each of three dealers. A basic objective was to sell the dealer's sales force on the benefits of electric fryers. In many cases, utility sales representatives picked up their prospects and drove them to the demonstrations.

Mailing pieces developed by the Commercial Cooking Committee of Edison Electric Institute and manufacturers literature were mailed at regular intervals to 3,300 food service operators. Prior to the campaign, Union Electric mailed an invitation to the food service operators to attend one of the demonstrations. Each dealer prepared invitations which were mailed to the company's food service list and to the dealer's prospects. Direct mail pieces totalled 23,100. Each food service operator received seven mailings during the campaign.

Before the campaign started, meetings were held with UE commercial sales representatives as a refresher course on the advantages of electric fryers.

Utility salesmen were given one point for each fryer sold. If the fryer replaced gas equipment, 1½ points were credited. Each salesman who scored four points received a 17-jewel wrist watch. In order to provide additional incentive, for eight or more points he received a second watch.

Consolidated Edison Pushes Dryers, Kitchens and Wiring

A clothes dryer promotion, a Kitchen Planning Service and up-to-date results of the company's adequate wiring program have been announced recently by Consolidated Edison Co of New York.

• Housewives with electric clothes washers and the new home market will be the major targets of a four months clothes dryer promotion planned by Con Edison for the fall. Promotional material will cover many avenues: TV and radio on almost a daily basis; newspaper ads; car cards; and posters on Con Edison trucks. Special dryer displays will be set up in company district offices. Five offices will feature dryers in their model kitchens.

• A Kitchen Planning Service will provide New York housewives with a photograph of a scale-model kitchen, tailor made to their desires.

The kitchen service idea grew out of Con Ed's survey of 1,531 housewives, the results of which were published in a booklet, "So We Asked The Ladies" (EW. Jan. 26, 1957, p 76) which showed bigger and better kitchens were wanted.

• Over 1,000 apartment buildings in Con Edison's service area have been rewired since the utility instituted an adequate wiring program five years ago. As of Aug. 11, 1,397 apartment buildings with a total of 56,038 dwelling units had been rewired. The number of buildings rewired since the program began has doubled every year. Last year, 505 apartment buildings were rewired, more than in the three previous years combined. The total for this year is 434.

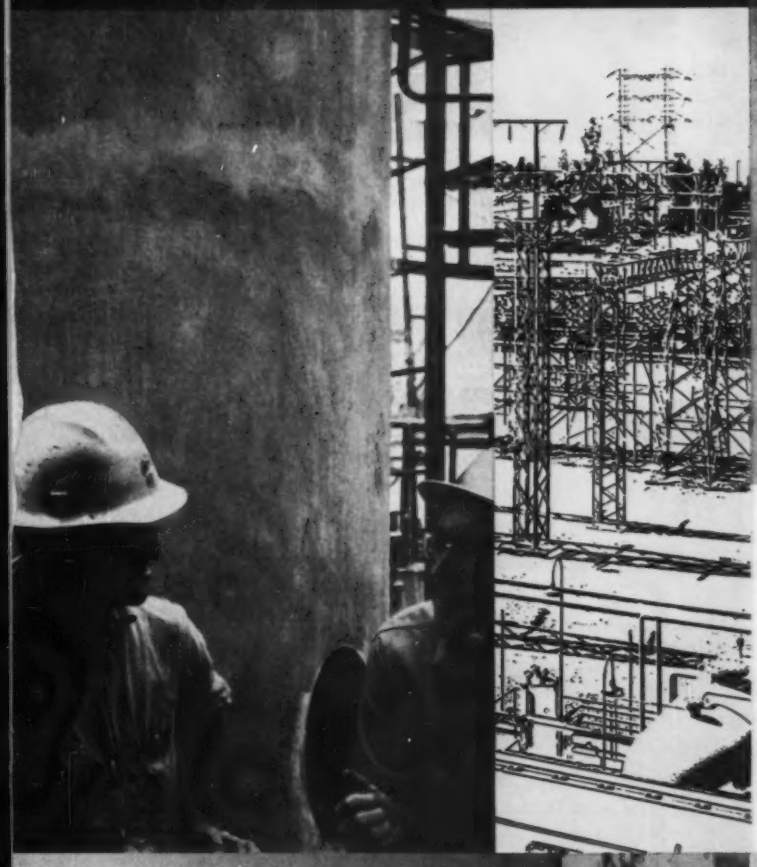
In 1957, the electrical capacity increase to each rewired apartment averaged 5,450 w, up 82% over the average capacity increase in 1954. In that year, only 14% of the buildings under construction provided 3-wire service to the apartment dwelling unit. Now, all of the apartment buildings begun this year, and 71% of the buildings started last year, have this higher capacity. Most have wiring for air conditioning.

One and two family homes rewired since the program began total 26,836. This plus apartment buildings, gives total of more than 80,000 dwelling units rewired.

Heating Division Moved

The manufacture and marketing of electric heating equipment by Westinghouse Electric Corp has been transferred from Sunnyvale, Calif., to the air conditioning division plant at Staunton, Va. This move was made because "the production and sale of electric heating equipment is more closely associated with the activities of the air conditioning division than with those of the Sunnyvale division," A. C.

(*More Selling on page* 94)



WHEN you consider expansion...
...the most important
investment you can make is in
the creative ability of men.

FLUOR

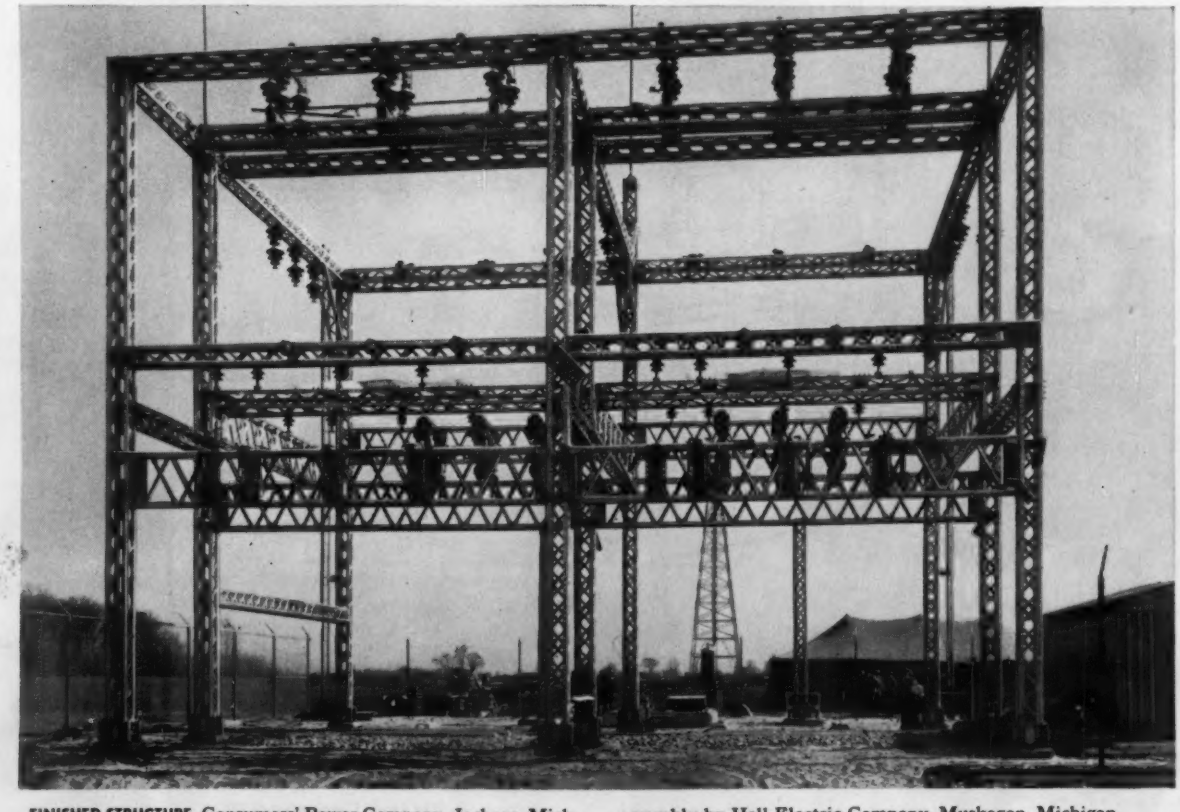
The Fluor Corporation, Ltd.
Engineers & Constructors
2500 S. Atlantic Blvd., Los Angeles

8 MEN...6 HOURS

World's First Alrectic* Standardized Aluminum

9 A.M. Pre-fabricated standard aluminum vertical columns and cross beams are assembled on the ground by an 8-man construction crew.

11 A.M. A single portable crane, which remained stationary, lifts each ground-assembled section upright onto concrete piers.

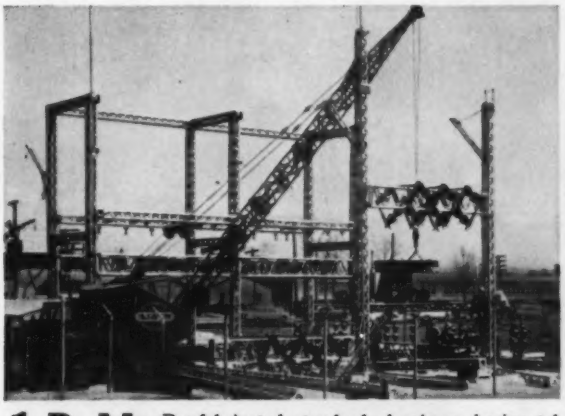


FINISHED STRUCTURE. Consumers' Power Company, Jackson, Michigan, 10,000 KVA-46KV/4.16KV substation located in Alma, Michigan. Designed with Alrectic modular components fabricated by Handley-Brown Company, Jackson, Michigan. Field assembly by Hall Electric Company, Muskegon, Michigan.

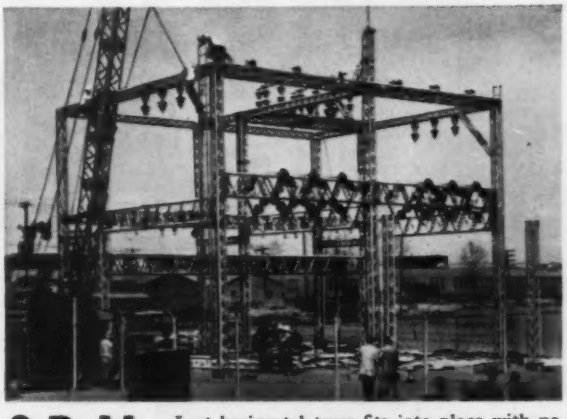
The Alrectic system was developed by Handley-Brown Company with design and engineering assistance from Consumers' Power Company and Kaiser Aluminum.

...AND IT'S UP!

Substation Structure Cut 22% Off Erection Costs



1 P.M. Pre-fabricated standard aluminum horizontal trusses are placed between vertical columns to form one wing of structure.



3 P.M. Last horizontal truss fits into place with no mechanical adjustment. Savings on erection costs: 22% less than conventional structures.

ALRECTIC—the newest development in erecting substation structures—is *up to four times faster than assembling pre-fabricated steel parts!*

One of the *pre-fabricated aluminum* truss sections utilized in the Alrectic method, for example, weighs only 145 pounds—298 pounds *less* than a similar pre-fabricated steel section.

These lightweight, shop fabricated aluminum truss sections eliminate the need for heavy lifting equipment. Aluminum subassemblies hoisted by a light crane can be pushed easily into place manually. Time and labor are saved, field assembly costs are reduced to a minimum.

Further savings are realized through reduced transportation, fabrication and engineering costs. The modular components facilitate field modification and mounting of electrical equipment.

Installed Cost Same As Steel

For most aluminum substation structures—of either modular or conventional design—installed costs are the same as their steel counterparts. In some cases, the installed cost of aluminum is even less than steel.

But the big bonus is in savings on maintenance!

Aluminum, unlike steel, requires no maintenance. It can't rust, is highly resistant to corrosion, never needs painting. *With aluminum, you pay nothing over and above the installed cost of the structure.*

May We Assist You?

Kaiser Aluminum engineering assistance is available, without obligation, for any application of aluminum in the Power Industry—aluminum substation structures, electrical conductors, components for bus systems, boiler lagging, insulation jacketing, structurals, roofing and siding.

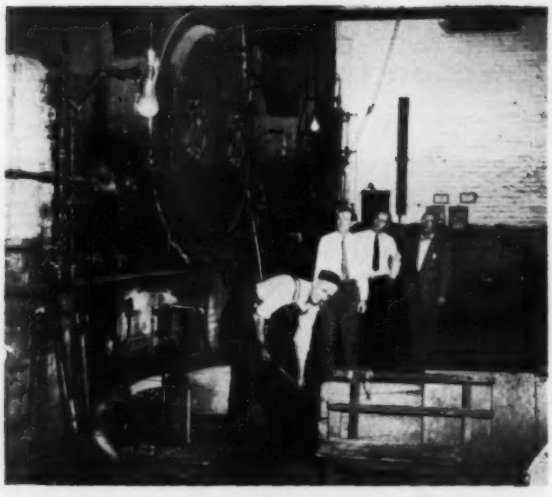
Kaiser Aluminum supplies leading fabricator-erectors with high quality American standard extruded structural shapes. We will gladly refer you to substation structure fabricators who are ready to quote realistic prices on aluminum now.

For immediate service, contact the Kaiser Aluminum sales office listed in your telephone directory. Or write: *Kaiser Aluminum & Chemical Sales, Inc., Dept. PR-917, 919 N. Michigan Avenue, Chicago 11, Illinois.*

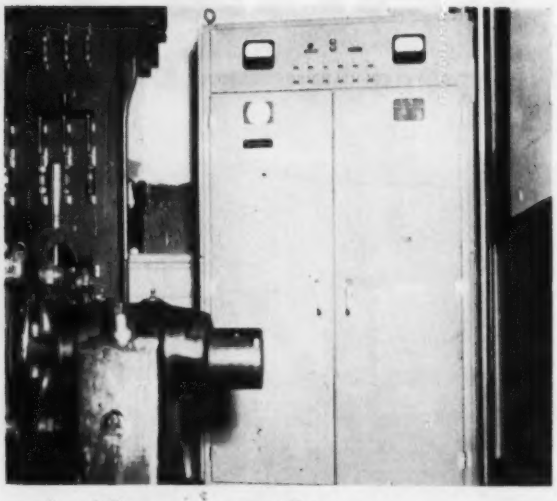
*Alrectic is a trademark of Handley-Brown Company

KAISER ALUMINUM

THE BRIGHT STAR OF METALS



Shutting down old boiler . . .



and adding new rectifier . . .

Modernization Pares Plant Production Costs

J. M. BLACKFORD, Division Sales Engineer, Connecticut Light & Power Co, Thompsonville, Conn

Using purchased power and a modern rectifier to supply d-c power for speed-controlled machines has cut production costs and assured a more dependable operation at the U. S. Envelope Co's White Corbin Div in Rockville, Conn. With a diesel engine and an old steam plant shut down, maintenance requirements are cut. Five mechanics are freed for preventive maintenance on production machinery. In addition, more than 3,000 sq ft of space was freed for production area. Even including the new a-c facilities, capital investment was held to only a fraction of the cost of replacement and modernization of the previous system.

All constant speed d-c current loads were converted to a-c operation and a compact 60-kw silicon rectifier was purchased to supply remaining d-c. Future plant expansion is not expected to increase d-c requirements from this source since new speed-controlled machines will be equipped with individual conversion equipment or adjustable-speed a-c motors.

Before the conversion was made, U. S. Envelope purchased only their a-c power. Approximately 750 amp of 120 v dc were supplied by a 150-hp diesel engine and a 125-hp steam engine. Steam was generated by two 150-hp boilers, hand-fired with coal. The boilers and the steam engine were near the end of their useful life. The plant heating required extensive modernization. Replacement and modernization of this equipment would have required a staggering investment with no promise of reasonable return. Process steam requirements were low compared with plant heating demands and this resulted in poor heat balance with high transmission and stand-by losses.

Conversion Cuts Salt Bath Maintenance

Replacing natural gas heat with 15 immersion type electric heaters has eliminated high maintenance costs and removed personnel discomfort caused by heat losses of the open flame at the Chain Belt Co in Springfield, Mass. Power costs are comparable to previous costs. Used to apply a special blue finish at temperatures of 700 F, the bath handles up to 800 lbs. of parts per hr. Temperature is thermostatically controlled.

Underground distribution system savings begin the day you decide to install J-M Transite Ducts. You can figure on lower operating costs, prolonged insulation life, more reliable service and longer cable life.

J-M Transite Ducts permanently resist fire and arc... provide lifelong dependability, many operating economies

GONE ARE MANY of the headaches of transmitting heavy electrical loads underground, when you protect cables with Johns-Manville Transite® Ducts. They assure you of greatest protective value, and maximum load capacity, per dollar invested.

And when cable fire or failure occurs, noncombustible Transite Ducts remain undamaged and can be used again for the new lines. Regardless of conditions, Transite Ducts provide permanent service as they do not deteriorate from heat, water or corrosive soils.

Tests have shown that Transite-protected cables run cooler under given loads . . . carry greater loads at given temperatures because Transite helps dissipate heat faster. And for lower operating costs, consider the long-range value of Transite Ducts in terms of (1) increased insulation life, (2) fewer cable failures, and (3) lower I^2R losses for the full working life of a system.

For details on Transite Ducts' many advantages, distribution engineers are invited to write for informative brochure EL-29A. Johns-Manville, Box 14, New York 16, N.Y. In Canada, 565 Lakeshore Road East, Port Credit, Ont.

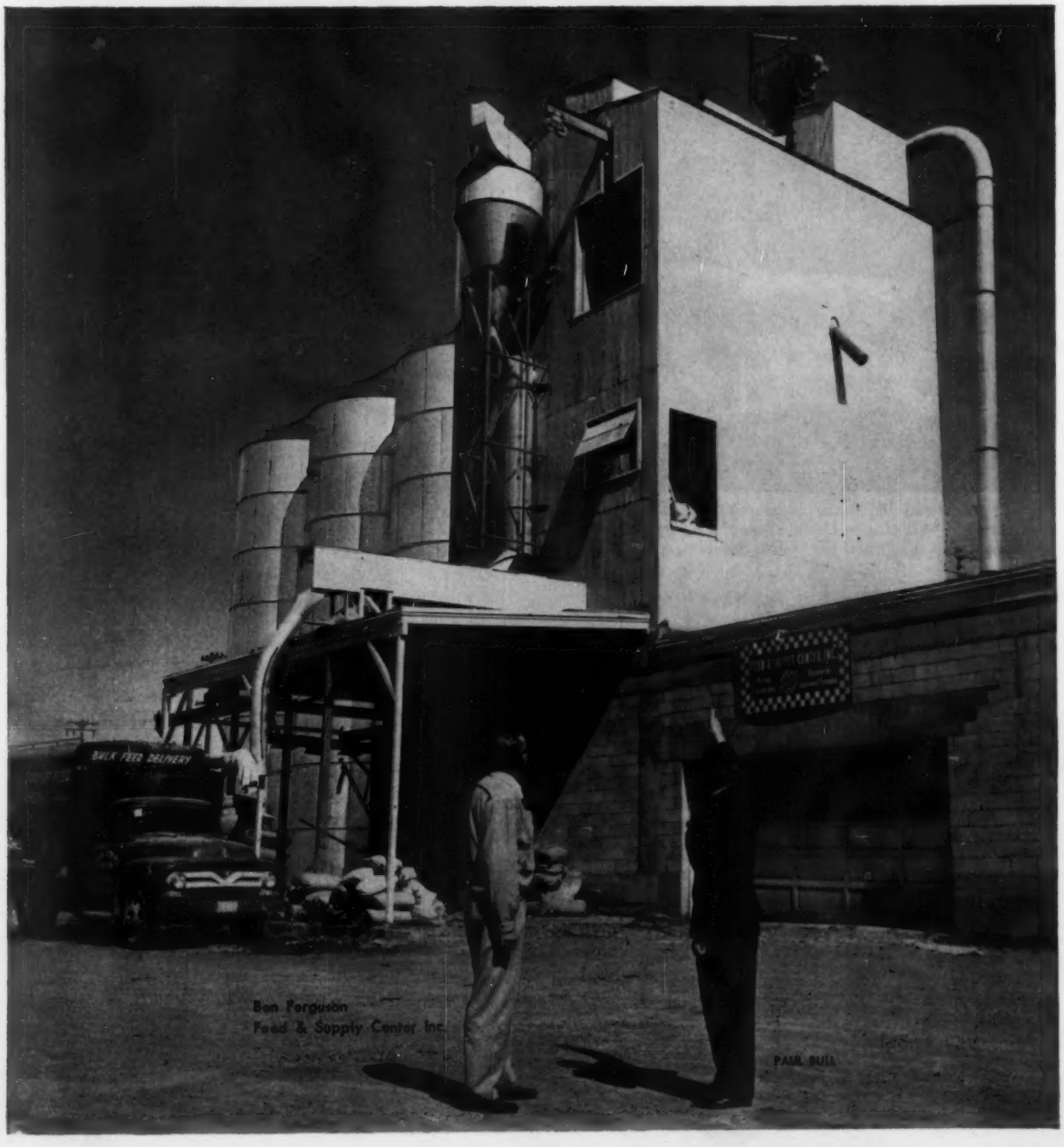
JOHNS-MANVILLE

JOHNS-MANVILLE JM PRODUCTS

"A bent shaft on an elevator motor might have caused a terrible accident

... *if Fusetron dual-element Fuses had not shut down the motor*"

PAUL M. BULL, Commercial,
Industrial Representative
Idaho Power Co., Twin Falls, Idaho



Mr. Bull continues:

"As a Commercial and Industrial Representative for the Idaho Power Co., I was asked to redesign the electrical work for the Feed & Supply Center Inc., Twin Falls, Idaho. The installation was handled by Detweiler, an electrical contractor.

"When the job was completed, Fusetron fuses kept blowing on a 15 hp., motor that operates the elevator.

"Larger size Fusetron fuses were tried and the result was almost disastrous.

"When the motor started the whole elevator shaft shook as if it would tear apart. Everyone was afraid that at any second the motor and apparatus would come crashing down the shaft.

"Fortunately, the Fusetron fuses opened and stopped the motor.

"A thorough check revealed that the shaft of the motor was bent in transit.

"If Fusetron fuses had failed to open to protect the motor, there might have been a terrible accident."

You too, can benefit by the 10 point protection of Fusetron fuses.

Fusetron dual-element fuses offer the safest, most complete electrical protection possible. With rare exceptions on commercial and industrial installations — ordinary fuses and circuit breakers protect only against short-circuits — but Fusetron dual-element fuses provide 10 point protection.

Why Risk Losses! One burned out motor . . . one needless shutdown . . . one destroyed switch or panel . . . one burned out solenoid . . . may cost you far more than replacing every ordinary fuse with Fusetron dual-element fuses.

BUSS Hi-Cap Fuses—High Interrupting Capacity above 600 and up to 5000 amperes

BUSS Hi-Cap fuses offer unlimited interrupting capacity for circuits of 600 volts or less. Their high speed operation on heavy shorts limits current to safe values. This minimizes damage to equipment and cuts down dangerous stresses on transformers.

These fuses can be coordinated with Fusetron fuses to isolate fault to circuit of origin.

BUSS Limitron Fuses — Limits Fault Current to Very Low Values

BUSS Limitron fuses have extremely fast opening characteristics to prevent heavy short-circuit currents from building up under fault conditions.

For more information write for —

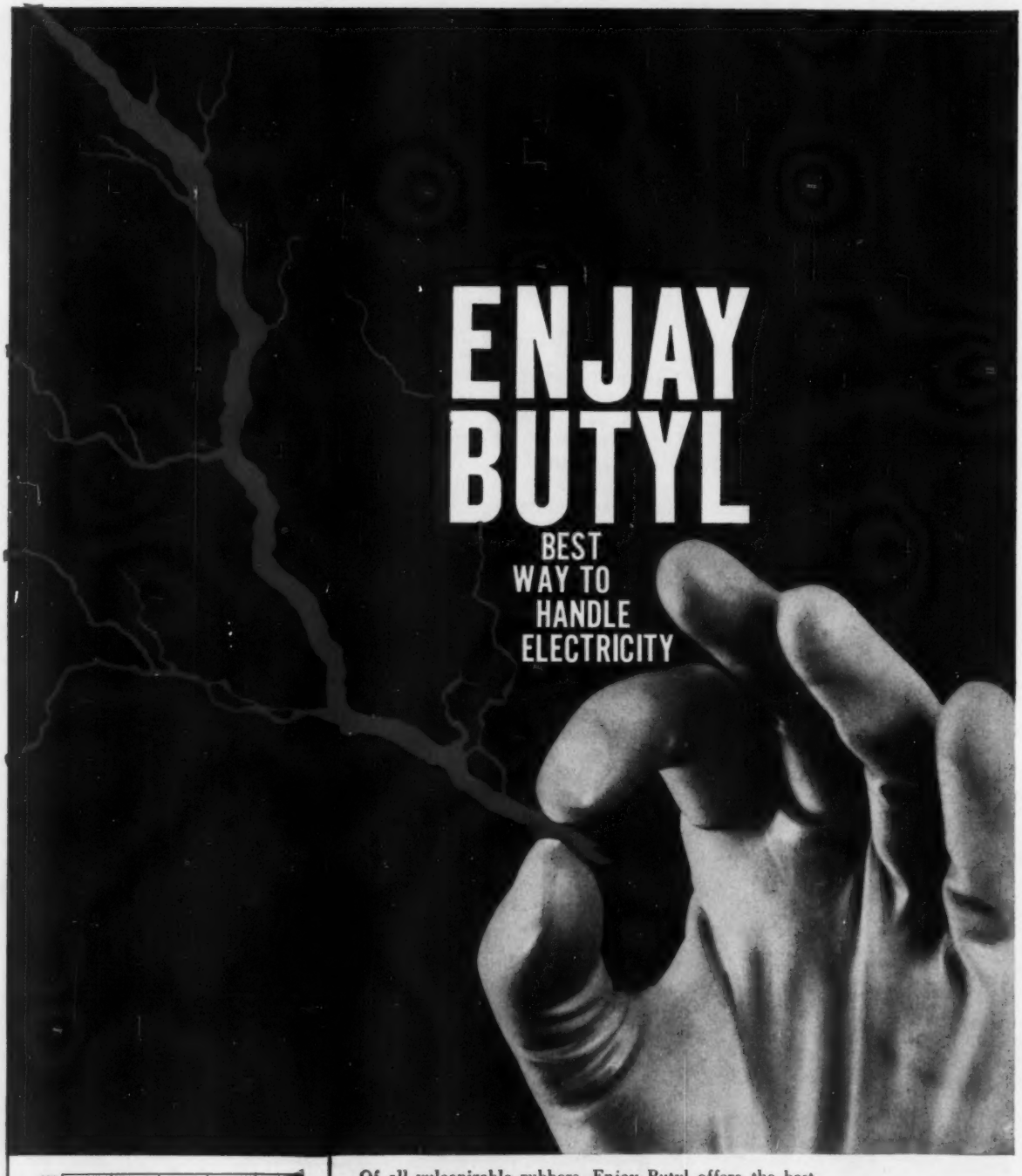
Bulletin FIS *on Fusetron dual-element fuses.*

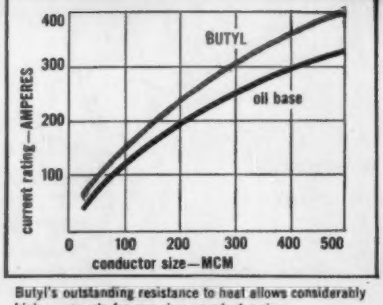
Bulletin HCS *on BUSS Hi-Cap fuses.*

Bulletin HLS *on BUSS Limitron fuses.*

Bussmann Mfg. Div.
McGraw-Edison Co.
University at Jefferson,
St. Louis 7, Mo.

Play Safe! install FUSETRON dual-element FUSES and BUSS Hi-Cap FUSES throughout entire Electrical System!





Butyl's outstanding resistance to heat allows considerably higher currents for any given conductor size.

Of all vulcanizable rubbers, Enjay Butyl offers the best electrical and dielectric properties. Butyl is the ideal material for wire and power cable, transformers, tapes, busbars and other insulation applications.

Butyl *also* offers outstanding resistance to weathering and sunlight . . . chemicals . . . abrasion, tear and flexing . . . superior damping properties . . . unmatched impermeability to gases and moisture.

Find out how this versatile rubber can improve your product. Call or write the Enjay Company, today!

ENJAY® BUTYL

ENJAY *Pioneer in Petrochemicals*

ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y.

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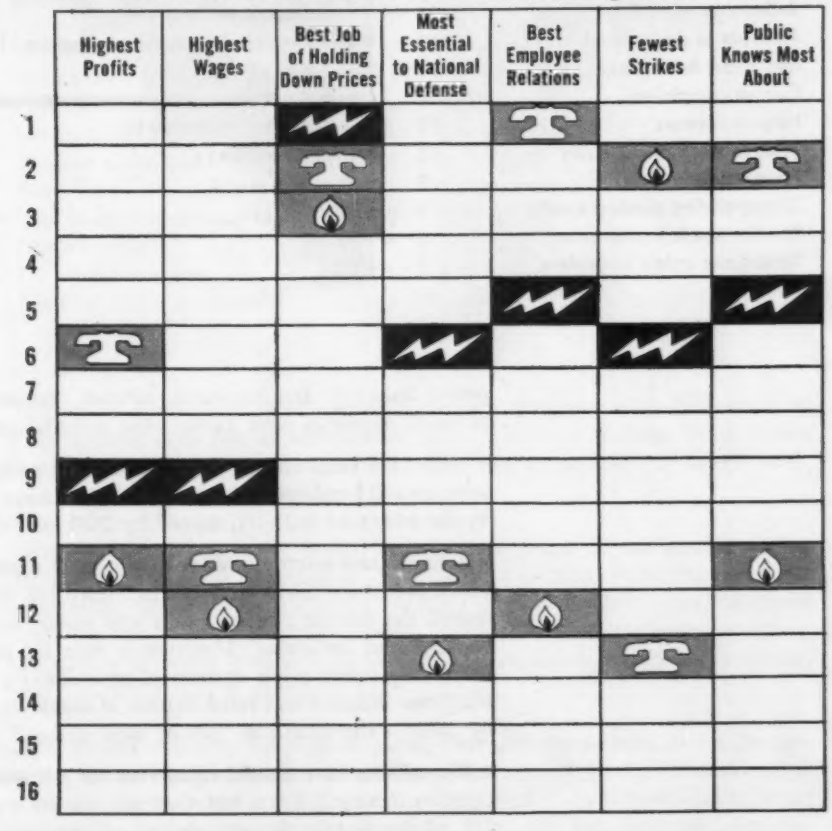
A Profile of the Utilities — ranked among 16 basic industries



How the Utilities Stack Up With the Public

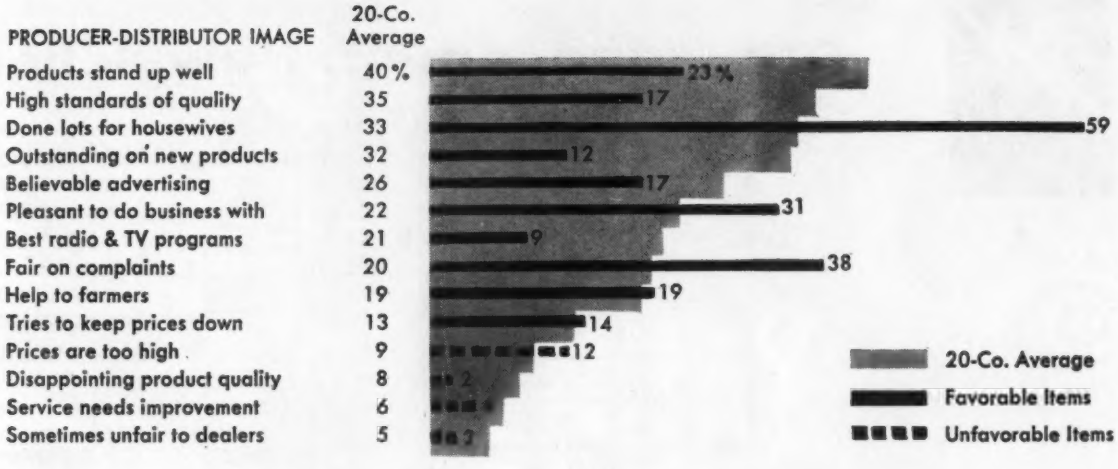
Public Relations

The electric utility industry rates high with the public, according to studies made recently by Opinion Research Corp of Princeton, N. J., but that doesn't mean there's no room for individual companies to improve their public relations. What people think of the whole industry influences the corporate image they assign to a particular company, the independent research organization has found, but this image is modified from company to company.

Opinion Research Corp queried a national sample of the population to measure the public's opinion of 16 industries. People were asked to select one or more industries which they thought best fit the characteristics listed across the top of the chart above. Their answers block in an interesting profile of the utilities' reputation against a backdrop of other major industries:

- **The utility industry has done the best job of holding down prices,** according to the survey. Fully 32% of the sample named the electric utilities. Telephone and natural gas companies were next, with 20% and 19%. Other regulated industries (railroads and banks) also got good ratings. It is likely, however, that many people give credit to the regulatory commission, not the company.

- **In the category "most essential to national defense,"** electric utilities rank in the middle range. 58% of the respondents thought this description fit the


PRODUCER-DISTRIBUTOR IMAGE
20-Co. Average
Products stand up well 40% 23%
High standards of quality 35 17
Done lots for housewives 33 59
Outstanding on new products 32 12
Believable advertising 26 17
Pleasant to do business with 22 31
Best radio & TV programs 21 9
Fair on complaints 20 38
Help to farmers 19 19
Tries to keep prices down 13 14
Prices are too high 9 12
Disappointing product quality 8 2
Service needs improvement 6
Sometimes unfair to dealers 5 3
20-Co. Average
Favorable Items
Unfavorable Items

power industry. But the steel, aircraft, petroleum, chemical, and electrical products industries were named even more frequently.

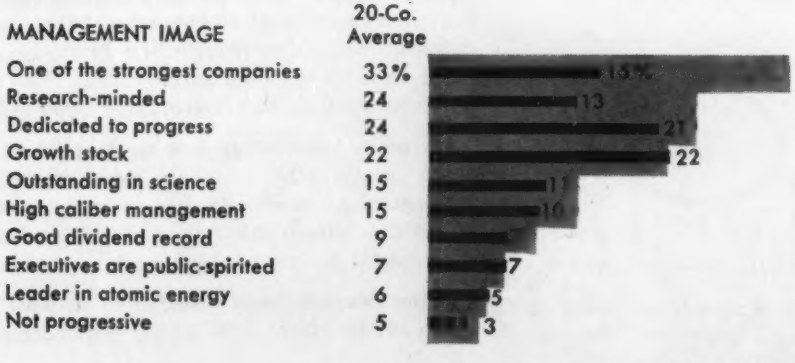
• **Only 13% cited electric utilities for "best relations with employees,"** but the industry still fared better than most. Highest score in this category was racked up by the telephone industry, named by 24% of the respondents.

• **Both gas and electric utilities have a good reputation for labor peace.** Asked which industries "have most strikes," only 1% listed the gas industry and 2% named the electric utilities. Steel was named by 74%, followed by the auto and railroad industries. However a vote on poor labor relations does not necessarily reflect a low opinion of an industry's treatment of employees: The telephone industry was rated highest in employee relations, but was also listed by 16% of the sample as "having most strikes."

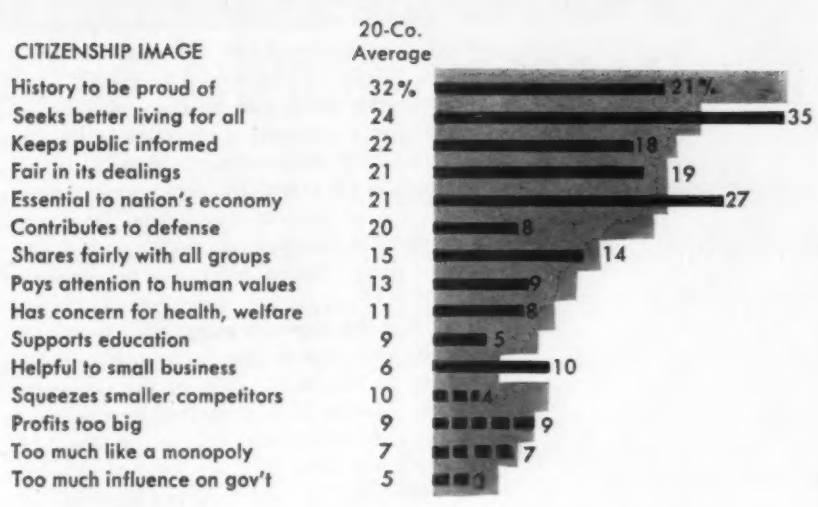
• **The utilities have a solid reputation for job security and fringe benefits,** says Opinion Research Corp, but they are not known for their good wages. Only 7% of the sample thought electric utilities paid "highest wages," while 6% checked telephone companies and 2% named natural gas.

• **The public gave utilities a backhand compliment on profits.** Only 8% thought the electric companies make "highest profits," with 6% naming the gas industry. This is a favorable rating, says ORC, since "high profits" have a bad connotation for many people.

Just as an industry is identified with certain characteristics, individual companies project a definite corporate image. The broad industry profile is reflected to some extent in the image of a particular company, but it is modified by the


MANAGEMENT IMAGE
20-Co. Average
One of the strongest companies 33% 13%
Research-minded 24 13
Dedicated to progress 24 21
Growth stock 22 22
Outstanding in science 15 11
High caliber management 15 10
Good dividend record 9
Executives are public-spirited 7 7
Leader in atomic energy 6 5
Not progressive 5 3

These Charts Depict the Corporate Image of One Electric Utility

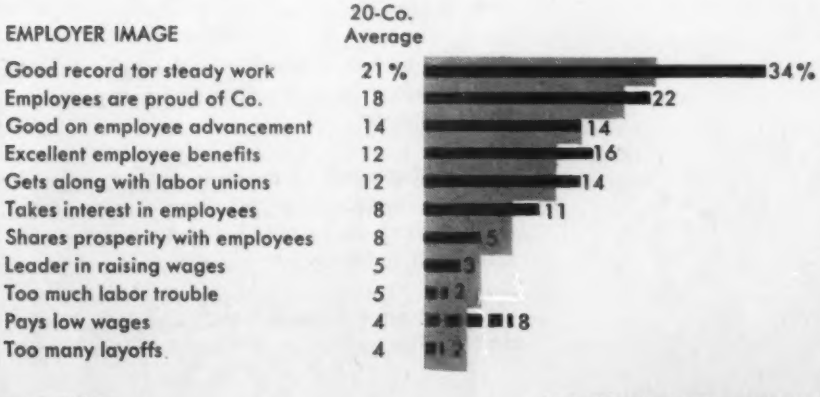

CITIZENSHIP IMAGE
20-Co. Average
History to be proud of 32% 21%
Seeks better living for all 24 35
Keeps public informed 22 18
Fair in its dealings 21 19
Essential to nation's economy 21 27
Contributes to defense 20 8
Shares fairly with all groups 15 14
Pays attention to human values 13 9
Has concern for health, welfare 11 8
Supports education 9 5
Helpful to small business 6 10
Squeezes smaller competitors 10 4
Profits too big 9 9
Too much like a monopoly 7 7
Too much influence on gov't 5 3

company's personality. This corporate image influences people constantly to take actions favorable or unfavorable to a company. It helps them decide whether or not to buy the company's products and services, to buy or sell stock, to take a job with one company or another.

The charts on these pages depict the corporate image of one electric utility, measured against the yardstick of 20 companies in other industries. To draw this image, Opinion Research Corp compiled a list of 50 descriptive statements covering the producer-distributor image, management image, citizenship image, and employer image. Interviewees were asked to check any number of items they felt were descriptive of the company.

This electric company has built up many favorable impressions, as can be seen from the charts. The public avows that it has "done a lot for housewives," is "pleasant to do business with," "fair on complaints," and "seeks better living for all." On the other hand, the public does not feel that this company "contributes to defense" as much as the average of the 20 corporations. The electric company was cited for its defense contribution less than half as often as a farm equipment manufacturer on the list, and companies from auto, rubber, and metal industries were given far more credit in this category

This company also rates surprisingly low as a "leader in atomic energy." Only 5% cited the utility for its atomic energy activities. In this connection, ORC notes that 68% have heard of producing electricity from atomic energy. But


EMPLOYER IMAGE
20-Co. Average
Good record for steady work 21% 34%
Employees are proud of Co. 18 22
Good on employee advancement 14 14
Excellent employee benefits 12 16
Gets along with labor unions 12 14
Takes interest in employees 8 11
Shares prosperity with employees 8 5
Leader in raising wages 5 3
Too much labor trouble 5 2
Pays low wages 4 18
Too many layoffs 4 2

only 6% can name any electric companies that are taking part in atomic energy development, while 33% give the credit to the government.

The corporate image can be changed. ORC likes to point out that its image profiles give a company a blueprint of its strengths and weaknesses, showing which areas of public relations demand effort. ORC cites one gas company that found itself tagged by stockholders with a very unfavorable management image. To rid itself of this stigma, the company has worked hard to stress management's qualifications in its annual and quarterly reports and in the financial press. The image has now brightened up considerably.

Where does the corporate image come from? ORC researchers have looked into that too. They find the sources vary from industry to industry. For the electric company in the study, 40% of the respondents were impressed through its services. Another 21% drew their impressions from dealing with the company. Talking with others was the source for 12%, and contact with company employees was listed by 8%. Reading about the company was the source for 7%, while ads, TV, and company literature accounted for 9% between them.

Business Paper Helps 10 Cities 'Pull Together'

Area Development

Iowa-Illinois Gas & Electric Co is quietly helping to spur area development in its bi-state service area with the publication of the "Quad City Commerce Quarterly," a summary of business conditions in Scott County, Iowa, and Rock Island County, Illinois. The Quarterly is distributed to about 4,000 business and civic leaders in the Quad City area, which straddles the Mississippi River and includes such cities as Davenport, Iowa, and Moline and Rock Island, Ill. It is a tool for selling the area's ten highly competitive cities on the idea that they are interdependent, socially and economically.

In the past, many of these cities' separate area development efforts have cancelled each other out. They have been competing among themselves without developing a positive industrial promotion program for the whole area.

Says Lewis H. Day, Director of Area Development for Iowa-Illinois G&E: "It is our thought—and hope—that by the honest and accurate reporting of business activity in the area the business community, at least, will come to accept the "oneness" idea and, perhaps, be encouraged to think beyond the confines of artificial political boundary lines established years ago."

The four-page summary includes a local business activity barometer and readable interpretations of significant statistics. It covers employment, sales, and farm prices as well as area development information and news of plant expansions in the Quad Cities area.

"There is nothing spectacular or dramatic about the Quarterly," says Day, "but we do think it has been helpful in bringing about a considerable change in community attitudes."

On the Illinois side of the river, Quad Cities business and professional people have now organized the "Blackhawk Industrial Development Association", and put it to work with a full-time staff. The company hopes that a similar organization will spring up on the Iowa side.

"It is our not-too-secret hope," says Day, "that then we will be able to lace the two sides together to do a really outstanding job of community building."

Yes, you can save cable dollars when you go to higher voltages!

For 15 kv and up—consider Anaconda Durasheath rubber-insulated, neoprene-jacketed power cable! Its lighter weight, flexibility of installation, ease of splicing may mean lower installed costs!

With today's trend toward higher and higher voltages, better look into the advantages of Durasheath*—Anaconda's superior-quality rubber-insulated power cable. It may mean big over-all cost savings!

New Anaconda insulating compounds, improved shielding, and advances in cable manufacturing technique have now made it practical to extend Durasheath's voltage range beyond 15 kv . . . to 25 kv . . . and to even higher voltages.

In lower and medium voltage ranges (600 volts to 15 kv), Durasheath has already earned an outstanding reputation for safety, dependability, long life—*and* money-saving versatility. For Durasheath can be installed overhead . . . in ducts . . . and underground, in continuous runs with minimum splices. Its flexibility and light weight are important, too, in cutting the costs of supporting structures.

Now, Anaconda's proven "know-how" in cable construction has made it possible to bring all these advantages to *high-voltage* Durasheath cable! If you're "going up" to higher voltages, see the Man from Anaconda about Durasheath. He will be glad to help you work out your particular problem. Or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York. *Trademark

ANACONDA DURASHEATH ALL-PURPOSE POWER CABLE

Available in all sizes, single and multiple conductor, copper or aluminum, 600 to 15,000 volts and higher.

INSULATION. Type RHW, Anaconda ANW, AHW or AB, each designed for specific purposes and described fully in new publication DM-5817.

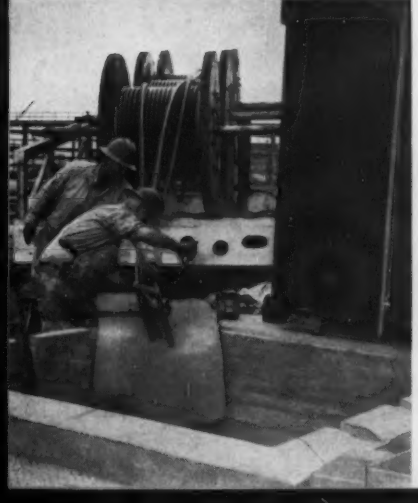
JACKET. Specially compounded neoprene with high resistance to flame, oil, acids, alkalies, sunlight and ozone, high tensile strength and flexibility at extremes of temperatures. Densheath (PVC) and Polyethylene jackets are available for special applications.

LIVE BETTER ELECTRICALLY

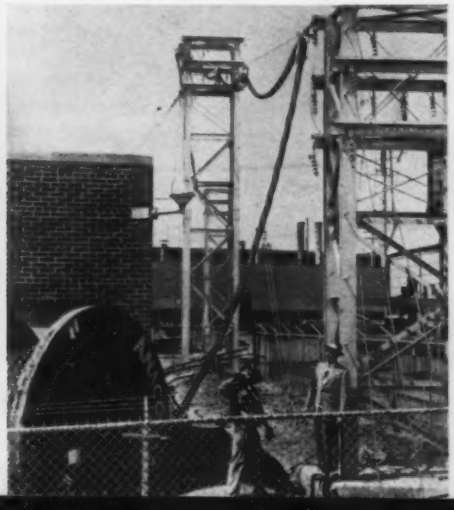
SEE THE MAN FROM
ANACONDA®
FOR DURASHEATH CABLE

Anaconda Durasheath is 3 cables in 1, because . . . it can be installed—

IN DUCTS



AERIALLY

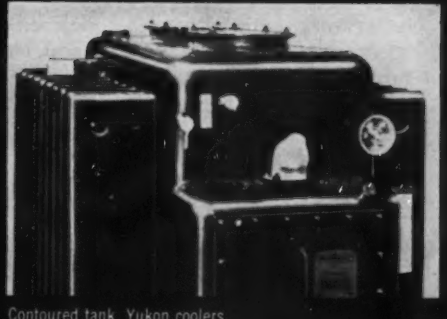


UNDERGROUND

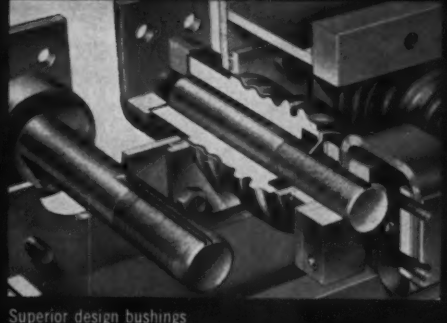
IMPROVE NETWORK RELIABILITY . . .

Space-Miser Transformers service-proved

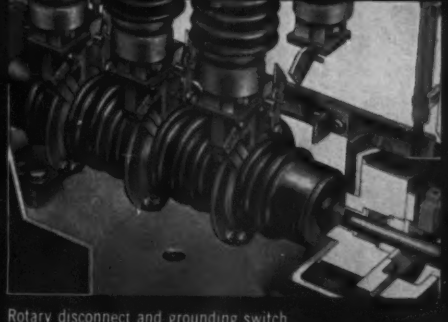
have been in 42 Network Systems



Contoured tank, Yukon coolers



Superior design bushings



Rotary disconnect and grounding switch

This SPACE-MISER being installed in the network system of Georgia Power Company assures this progressive utility of improved network reliability.

Here is the *sure* way to improve network reliability: put SPACE-MISER transformers in your network vaults. Since the SPACE-MISER was introduced two years ago, its reliability has been thoroughly proved in 42 network operations throughout the country.

This reliability is inherent in the SPACE-MISER design. Here are some of the outstanding SPACE-MISER features that will help you improve your network reliability:

CONTOURED TANK AND YUKON COOLERS—The SPACE-MISER design eliminates sharp corners and allows a uniform finish to be applied for better corrosion protection. This extends the period between scheduled inspection and maintenance on coolers.

SUPERIOR DESIGN BUSHINGS—Rolled-flange gasketed bushings with retained gaskets and metal-to-metal stops are standard equipment. Similarly constructed low-voltage bushings with inert-arc weld seal can be supplied. Use of either of these bushings eliminates shutdowns for bushing maintenance.

ROTARY DISCONNECT AND GROUNDING SWITCH—The one-piece porcelain cylinder with babbitted-in contacts is keyed to a full-length stainless steel shaft. Metal-to-metal stops for the retaining rings in the shaft seal assure that the correct pressure is applied to the silicone-rubber bushing.

OVERLOAD CAPACITY—Overload capacity has been maintained in the SPACE-MISER. This assures reliability to meet emergency overload conditions.

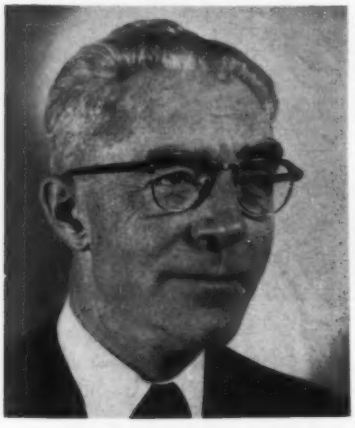
In addition to these excellent reliability features, the SPACE-MISER transformer is 20 per cent smaller. This makes installation and change-out easier and faster, gives extra space in existing vaults or permits new vaults to be built smaller.

The SPACE-MISER is another example of how Plowback of Earnings into research and development at Westinghouse is bringing the electric utilities big benefits—in tomorrow's apparatus, and today's. For further information on how the SPACE-MISER transformer improves network reliability, call your nearest Westinghouse representative or write Westinghouse Electric Corp., P.O. Box 868, Pittsburgh 30, Pa.

J-70888

YOU CAN BE SURE...IF IT'S **Westinghouse**

Ainsworth Heads Canadian Electrical Assn



V. A. "Red" Ainsworth, general manager of Newfoundland Light & Power Co, has been elected president, Canadian Electrical Association.

A native of England, Ainsworth journeyed to the U. S. at the age of 22. With $150 in his pocket and several letters of introduction he set out upon his utility career in New York City, first with the Brooklyn Edison Co, later with Staten Island Edison Co.

His first Canadian position brought him to Fredericton, New Brunswick, where he was made division manager by Maritime Electric Co. He was elevated to general manager in 1947, and retained that position until joining Newfoundland Light & Power in 1953.

Active in other association work, he is an associate member of AIEE, a member of Engineering Institute of Canada and past chairman and present member of the Institute's Newfoundland Branch.

PEPCo Appoints Purchasing Manager, Agent

Potomac Electric Power Co has appointed John C. Herbert, manager-purchasing & general services, and Aaronson E. Stant, purchasing agent.

Herbert, who was formerly purchasing agent, has been with the utility for 33 years. In his new position he will be responsible for purchasing and stores, motor transportation, building operations, police, central file, and telephone services.

He is a member of National Association of Purchasing Agents and EEI.

Stant, PEPCo's new purchasing agent, has been with the company since 1926. He had been made assistant purchasing agent in 1956.

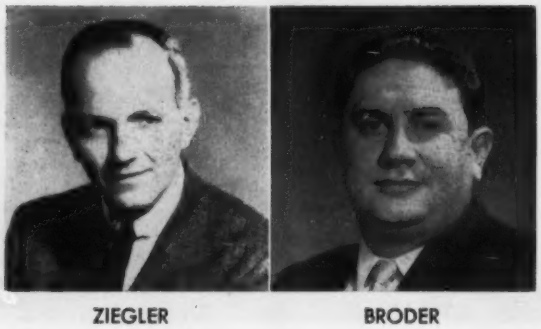
HERBERT STANT

Rome Cable, Royal Electric, Name Vp's

In recent promotions by electrical manufacturers Allan M. Ziegler was elected vice president, Rome Cable Corp, and Leonard Broder was promoted to vice president-marketing, Royal Electric Corp.

Rome Cable's new vice president had served as general manager of the T. J. Cope Division, manufacturer of extended-metal cable supports, since 1955. The Cope organization was purchased by Rome Cable in 1957.

Royal Electric's new vice president joined the company in 1956. In his new capacity he will be responsible for all manufacturing operations of Royal's three plants.

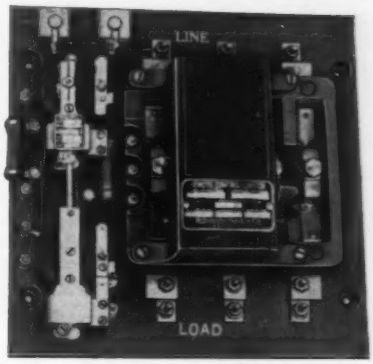


ZIEGLER BRODER

K·M
BEST IN ASBESTOS

"K&M" Ebonized Asbestos

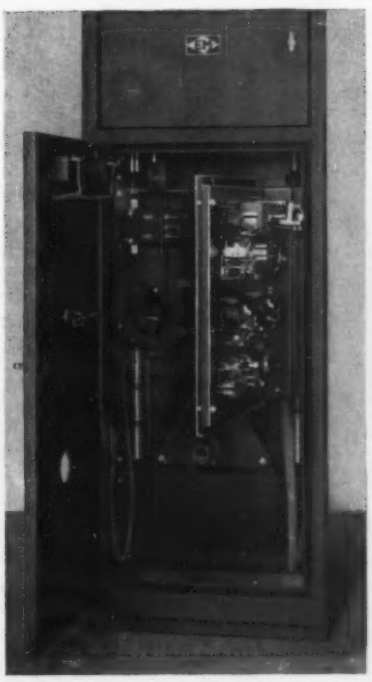
Combines
High Dielectric Strength,
Physical Ruggedness,
and Easy
Machinability!



PRIMARY SWING PANELS

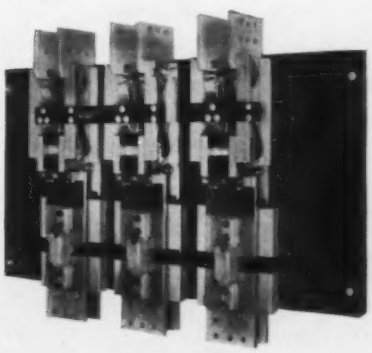
High Dielectric Strength! "K&M" Ebonized Asbestos has a dielectric strength that ranges from a minimum 50 volts per mil. at thickness of ½" or less to a minimum 25 volts per mil. at thicknesses of 1¾" to 2".

SWITCH BASES



Tough and Long-Lasting! "K&M" Ebonized Asbestos remains unaffected by rapid temperature changes, and by severe shocks and vibrations. Resists fracturing and moisture infiltration. In fact, it actually gets tougher as it grows older.

Easy to Work! You can machine "K&M" Ebonized Asbestos without its chipping, splitting, or cracking. And, it's easy to handle because of its relatively light weight.

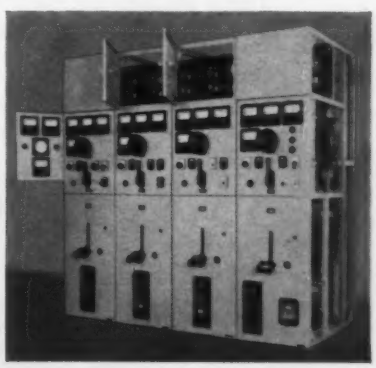


SWITCH PANELS

A range of thicknesses. "K&M" Ebonized Asbestos ranges in thickness from ⅛" to 4". Sheets are 4' x 8' (or smaller on order). Density is uniform.

Write to us today for more information on this rugged material for mounting practically every type of electrical apparatus.

CONTROL PANELS



K·M
BEST IN ASBESTOS

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

Nelson 2300 volt motor starters provide electrical control of pumping operations at Park Cities Water Treatment Plant, Dallas, Texas.

Over 7 years... Over 57,480 hours Continuous Operation!

That is the history of the 2300 volt Nelson Motor Starters in the Park Cities Water Treatment Plant, Dallas, Texas.

During these 7 years, only routine maintenance has been required. Needless to say, the owners are extremely well pleased and have ordered additional Nelson equipment.

Performance records such as these are the reasons why more and more Nelson quality-built electrical control equipment is being specified.

Find Your Nearest NELSON Representative in the 'Yellow Pages'

When you need electrical control equipment look in the yellow pages for the name of your Nelson representative, or write the factory for information.

a major source of electrical control equipment for industry

NELSON Electric MANUFACTURING CO.
TULSA, OKLAHOMA

William D. Rankin has been promoted to general line foreman, and **James C. Hansen** assistant superintendent of electric operations, at the New London Division, Hartford Electric Light Co.

T. E. Roach, president of Idaho Power Co, whose company is harnessing the hydro potential of the Snake River, has been made an honorary tribesman by the Pocatello Chiefs. He will be known as "Big-Chief-Makeum-River-Works-Like Squaw".

Duquesne Light Co has appointed **C. V. DeWitt** director of heavy industrial sales, and **M. F. Frable** director of light industrial sales.

Central Louisiana Electric Co has elevated **Whitten W. Davis** to manager, Pinesville Division. New local manager at Olla is **Buddie N. Davis.**

At Potomac Edison Co. **Gilbert P. Bohm** has been made commercial manager for the Hagerstown district.

Harold Fraley is new assistant manager of the Martinsburg district, and **George W. Baker** succeeds him as Boonsboro local manager.

John Moorman has been made assistant manager and **Charles Johnson** business development supervisor for Interstate Power Co's central district. In another promotion, **James E. Ryan** became field construction engineer.

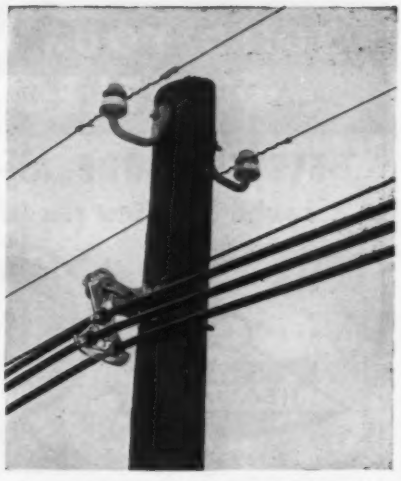
Derek Richardson has been elected vice president-aluminum sales, Metals Division, Olin Mathieson Chemical Corp.

Electronics Division, Diamond Power Specialty Corp, has made **Hugh S. Christian** division chief engineer.

Harold A. Jones has been appointed vice president and Eastern manager for Motorola Communications & Electronics Inc.

Federal Pacific Electric Co has named **Daniel W. Boone** director of inspector relations . . . **Clinton F. Kucera** is new manager of the New York district office of Allis-Chalmers Industries Group.

New Roeclamp with Roeplastic® Cable Costs 60% Less than Self-Supporting Cables, Minimizes Tree Problems, Installs with Ease, Looks Better!*



New Roebling ROEPLASTIC Cable with ROECLAMP requires only one foot of clearance through trees! Note improved, compact appearance. No crossarms are needed.

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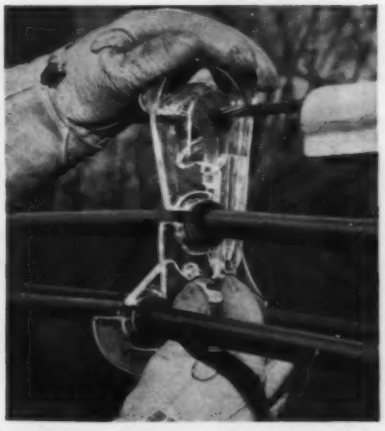

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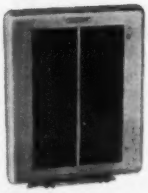

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SALES ASSIGNMENTS

REPRESENTATIVES

Sorgel Electric Co has appointed Control Switches Inc as representatives for Southern California.

Sylvania Electric Products Inc has appointed Ralph Bogan Jr & Co as representatives for Chicago sales of the company's flourescent fixtures and lighting systems.

C&D Batteries Inc has added the following representatives to its sales staff: Robert J. Brown, Charles F. Gross Associates, Philadelphia; Arthur F. Crowe, Packaged Industrial Power, Inc, Jersey City, N. J.; Albert S. Schnyder, Gregory-Salisbury & Co, Mobile, Ala.; James W. Kent, Hubill Co, Bettendorf, Iowa; and Joel Scallen, the Battree Co, Minneapolis.

Automatic Switch Co has appointed the following authorized stocking distributors of Asco solenoid valves: Berkness Control & Equipment Corp, Richmond 19, Va.; and Kelburn Equipment Co, Berwyn, Ill. Company's representative McNay Equipment Co has moved to 9500 Kenwood Road, Cincinnati 42, Ohio.

Kuhlman Electric Co has appointed the following representatives: Gakle Sales, P. O. Box 905, Minneapolis 40, Minn., for the state of Minnesota and local trade areas and Hollis R. Johnson, 5528 Timberwolf Drive, El Paso, Tex., for West Texas and New Mexico.

COMPANY STAFFS

Rome Cable Corp has named James W. Campbell, Jr, sales representative in the St. Louis area. W. Richard Copp has been made sales representative at the New York office.

Permutit Co has named as regional managers J. I. Munson, for the North East region with offices in New York; D. C. Senges, central region, Philadelphia; H. H. Morrison, South East region, Chattanooga; and W. H. Mitchell, Midwest region, Chicago.

Allis-Chalmers Manufacturing Co has appointed Ralph L. Haney as manager of the Philadelphia District, and Charles E. Dandois as manager, Allentown, Pa, district. New resident representative at Albuquerque, N. M., is Russel A. Erickson, while Y. S. Hogg is manager of the Tampa, Fla., district.

Babcock & Wilcox Co's tubular products division has promoted G. H. Weight to manager-middle states sales; J. H. Roach to district sales manager, Tulsa, Okla.; and W. C. Mohrman to Houston, Texas, district manager. A. M. Lockett & Co Ltd, B&W sales subsidiary, has named Joseph J. Ranna New Orleans District manager.

Brown Boveri Corp has named William Sailers manager of the company's new Texas regional office in Dallas.

Controls Co of America has promoted Jack Shnable to West Coast general sales manager.

Candian Westinghouse Co has appointed A. A. McArthur manager of apparatus sales.

Exide Storage Battery Co has promoted Robert J. Muth to field sales manager.

Graybar Electric Co has elevated B. F. Benning to general manager of lamp and lighting sales. In other promotions, L. A. Peterson has been named district operating manager at Seattle; E. J. Hoff steps up as Fort Worth manager; C. M. Newbill has been elevated to San Francisco district sales manager; C. C. Ross as Dallas district manager; J. K. Wyatt as Columbus, Georgia manager; J. L. Hoagland to Milwaukee manager; M. J. Sullivan as Youngstown manager; and A. N. Saxon as Jackson, Miss., branch manager; and E. P. Kempen as manager at Corpus Christi, Texas.

Federal Pacific Electric Co has announced four sales-staff promotions in the South and Southwest. W. L. Sullivan becomes southeast regional manager, Glenn Ellis moves to Dallas district manager, Ted Beyert to Houston district manager and Felix W. Truss Jr to Kansas City district manager.

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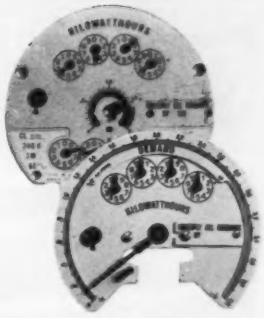

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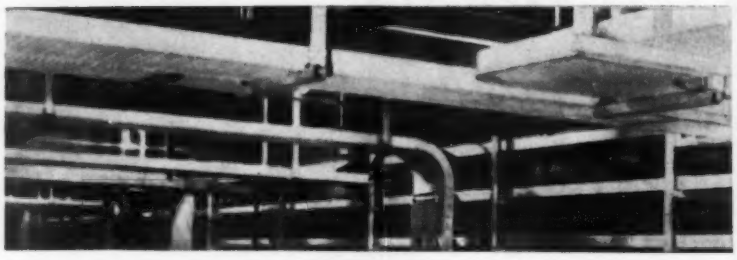

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Readers Forum

Britain's Appliance Business

To the Editor:

Mr. R. H. Sessions, who contributes the article on public relations, in your issue of 21st April, gives your readers a completely inaccurate and misleading impression about retail trading in the electricity supply industry in this country. The story which he describes as "true" is, in fact, more "fairy" than Hans Andersen.

There is no foundation whatever for the statement that "once upon a time in England the utility business turned over all of its appliance sales and servicing to dealers". Before the industry was nationalised in 1948, about two thirds of electricity supplies were in the hands of municipalities and one third in the hands of companies. The majority of the former and a large proportion of the latter engaged in the retail selling of electrical appliances and fittings through their service centres, and because of the public demand for a full electrical service this work has been expanded and carried on by the Area Electricity Boards on a nation-wide scale. The work of private dealers has similarly expanded.

Soon after nationalisation principles were agreed governing the relations between the Boards and the private contractors in these matters and a fair trading policy, which operates satisfactorily, was also evolved.

It would be interesting to know upon what evidence Mr. Sessions makes the astounding statements that on the prospects of nationalisation the independent dealers adopted a policy of "giving poor service and shoddy workmanship to the consumer in return for unusually high prices", and that within 60 days after nationalisation Government display cases (the Government have never been in the business!) were filled with under-priced appliances and dealers forced out of business.

To represent such a travesty of facts as a "true story" casts a reflection on the electricity supply

(*Continued on page* 114)

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3	300	West.	69,000-6900
3	200	West.	44,000-480
1	5000	West.	34,500-13750/6875, 3 Ph.
1	3750	G.E.	34,400-13,800/7960, 3 Ph.
2	3000	Uptegraff	34,750-4160 3 Ph.
2	3000	Stand.	33,000-4160, 3 Ph.
1	1500	Mol.	34,500-460, 3 Ph.
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3	1000	A.C.	34,650/11,500-2300
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2	1500	G.E.	23,000-2400/4800, 3 Ph.
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3	1667	G.E.	13,800-600
3	667	Kuhl.	13,800-480
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3	333	Uptegraff	13,800-480
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(Continued from page 112)

industry in this country which it is necessary to repudiate with the utmost vigour.

W. J. Hendry
Public Relations Officer
The Electricity Council
Secretary's Office
Winsley Street, London, W. 1

Author Replies

Dear Mr. Hendry:

The Editor of Electrical World has provided me with a copy of your letter wherein you take exception to a portion of my article, "Let's Be Sensible About Public Relations." You express interest in knowing upon what evidence I base my contentions regarding the forces that were at work in the socialization of the electric industry in England prior to 1948.

My informant is a business man in Harrow, and at the time I visited with him, his own business was threatened with being "nationalized" which he aptly described as the process of "letting the tail go with the hide." Since he knew I was in the electrical business, he passed along the complaints and grievances of his electrical business friends who were then in the process of learning about "nationalization principles." He obviously is on the opposite side of the political fence from the advocates of socialism, and I do not care to give you his name without his permission.

It would be interesting to know by what mental process it is possible to make a distinction between nationalization and socialization when the end result is the same. For example, you stated in your letter that "the Government has never been in the business" (of handling electrical appliances and fittings), and yet you also state that prior to 1948 about two-thirds of electricity supplies were in the hands of municipalities, and that a majority of these municipalities were engaged in retail selling of electrical appliances and fittings through their service centers. Is it possible that my informant was referring to municipal government in England rather than national government? You will note that the article speaks of a utility company and what happened when "nationalization principles" were applied to it.

I think it would shed some light on what we are trying to discuss if it was known just how soon after "nationalization principles" were applied that a "fair trading policy" was evolved. The majority may think it is fair now; but what did they think ten or twelve years ago?

I can well imagine that the persistently typical "public demand for a full electrical service" slogan of the socialists has expanded the costs as well a the service. I speak of costs, (the big fat bureaucratic kind) —not rates. All may not be lost though—as I note in the New York Herald Tribune for February, 1958, that International Research Associates have allegedly found that today only 8% of the British public favor government ownership and management of large industries. This low figure probably would not apply to the utility business because the process of socialization or "nationalization" began with municipal governments, and this paved the way long before 1948 for the final centralization of the power business.

R. H. Sessions
Personnel Director
Idaho Power Company
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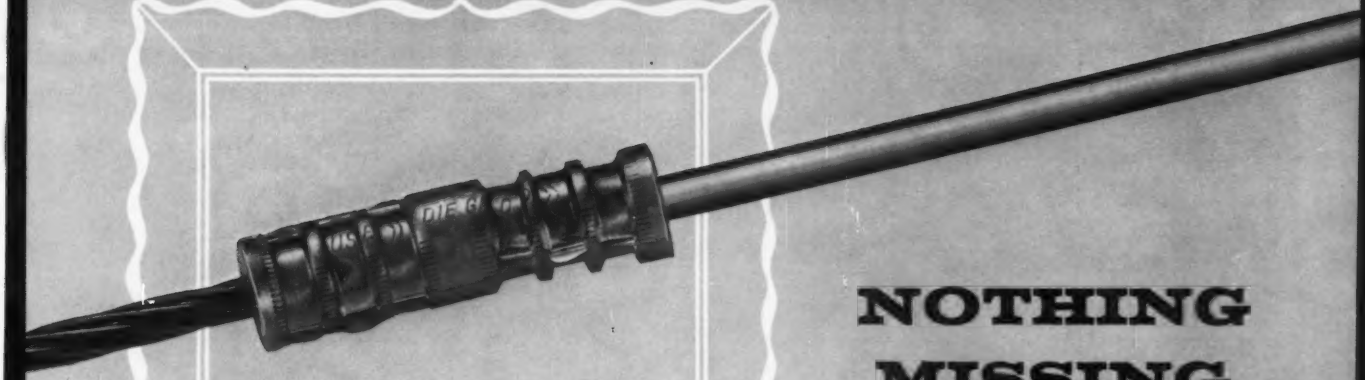
EQUIPMENT (Used or Surplus New) For Sale 113



NO-MELT INHIBITOR

CLEAR MARKING

BRIGHT COLOR CODING

SNAP CAPS

½" & ⅝" DIAMETERS

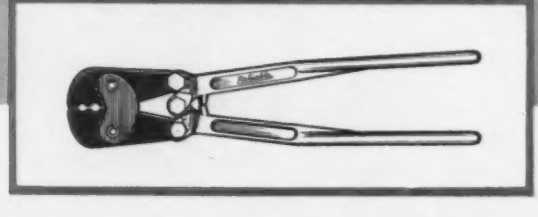
NOTHING MISSING IN THIS PICTURE

Reliable Aluminum Service *SQUEEZ* Sleeves give you everything — including an inhibitor compounded with granular additives in a no-melt petroleum base. Joints are sealed, excellent contacts induced by the additives are protected. The inhibitor compound has a temperature range of —10° to +600°F.; there is no melting point.

Reliable Aluminum Service *SQUEEZ* Sleeves are unusually well marked, capped and color coded. Name, catalog number and die groove are clear. Inhibitor is in measured amount.

Magnified photo of Reliable's no-melt inhibitor shows *contact inducing* additives suspended in *contact preserving* silicone thickened base.

½" and ⅝" sleeves use standard "X" and "Y" die grooves, or tested substitutes, for compressing.



A HALF CENTURY OF SERVICE TO THE UTILITIES

Reliable ELECTRIC COMPANY • FRANKLIN PARK, ILL.

NOW

LOWER IMPEDANCE
IMPROVED REGULATION

The new Moloney Distribution Transformers have coils with lower impedance to provide a lower internal voltage drop at all loads. This means that during peak load periods Moloney's new distribution transformer can carry higher overloads at the same permissible regulation.

Other features of the coil construction are:

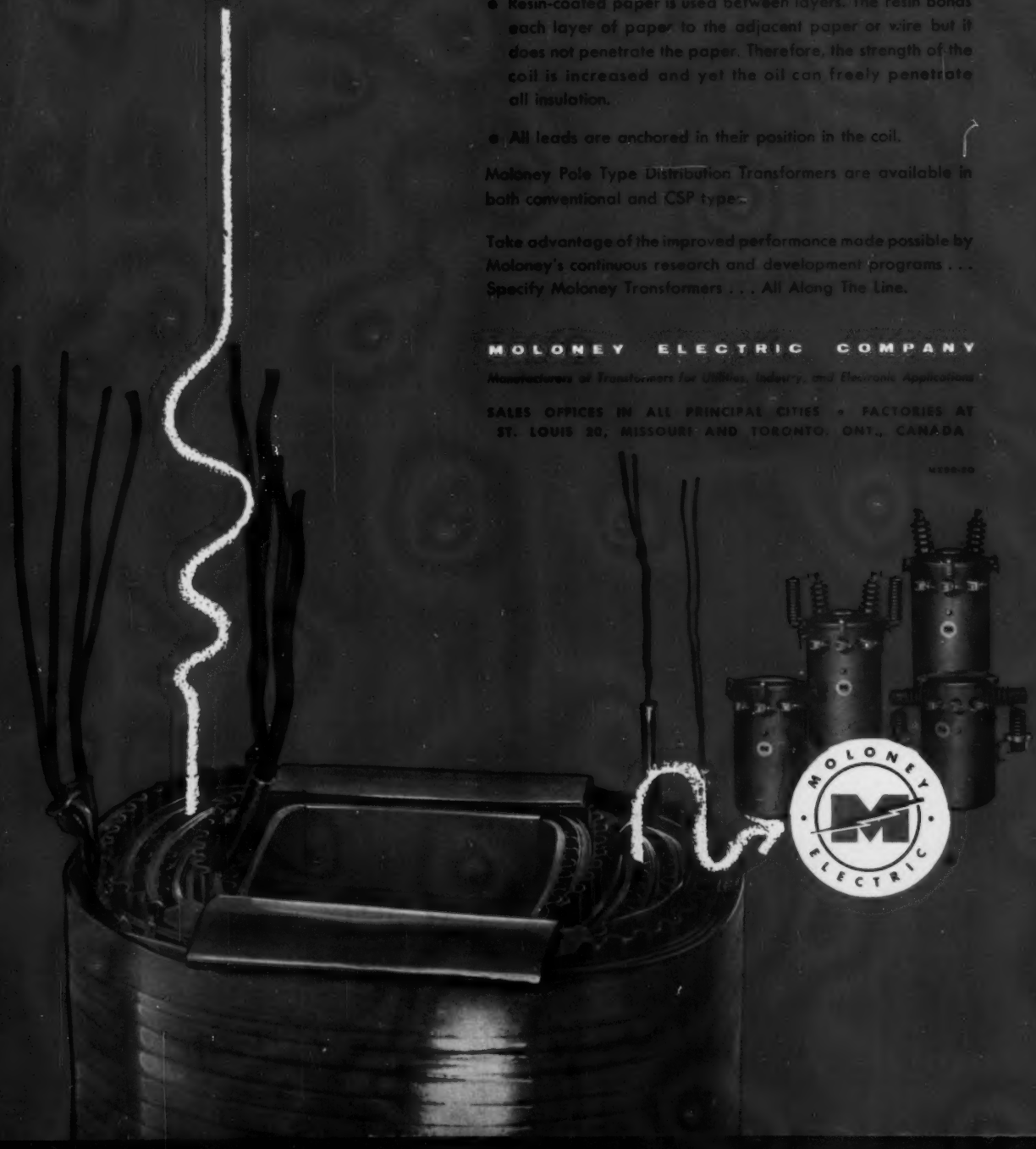
- Numerous cooling ducts located so that the coils are cooled rapidly thereby obtaining low hottest-spot temperatures and assuring high short-time overload capability.
- Liberal use of insulating materials throughout the coil with extra insulation on the turns at the line ends of the coil to enable them to withstand lightning surges.
- Resin-coated paper is used between layers. The resin bonds each layer of paper to the adjacent paper or wire but it does not penetrate the paper. Therefore, the strength of the coil is increased and yet the oil can freely penetrate all insulation.
- All leads are anchored in their position in the coil.

Moloney Pole Type Distribution Transformers are available in both conventional and CSP types.

Take advantage of the improved performance made possible by Moloney's continuous research and development programs . . . Specify Moloney Transformers . . . All Along The Line.

MOLONEY ELECTRIC COMPANY

Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MISSOURI AND TORONTO, ONT., CANADA

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